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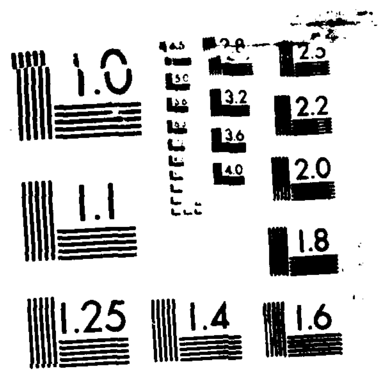

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ABSTRACT OF DISSERTATION

Robert Craig Ham

The Graduate School
University of Kentucky

1986

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Recent efforts in urban geography have sought to incorporate the time dimension into spatial analysis. While a number of different approaches have been utilized, most can be collapsed into two fundamental contexts: one-directional change and repetition. The central thesis of this study holds that time, in its cyclical sense, creates distinct space-time landscapes, and that discrete time blocks translate into usable analytical aids for the social/behavioral scientist, and effective management tools for those who must

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Crime events are plotted over time to determine the pattern for eight crime types, and hours of the day are collapsed into six statistically significant four-hour "time slices". Matrices with 312 Space-Time Units (52 census tracts x 6 time slices) and 364 (52 x 7 days of the week) Space-Day Units are formed. Regression analysis is then used to test the significance of traditional socioeconomic predictor variables in explaining the variance among crime rates within the Space-Time and Space-Day Units.

Time factors are then added to each equation as categorical variables, and the regression analyses are repeated to determine the increased explanatory power attributable to the time dimension. Significant improvements are noted--particularly with respects to violent crimes such as assaults.

TIMING AND SPACING CRIME IN THE URBAN ENVIRONMENT:

LEXINGTON-FAYETTE COUNTY, KENTUCKY - 1985

ABSTRACT OF DISSERTATION

A Dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at The University of Kentucky

By

Robert Craig Ham

Lexington, Kentucky

Co-Directors: Dr. Stanley D. Brunn, Professor of Geography
Dr. Carl G. Amrhein, Assistant Professor of Geography

Lexington, Kentucky

1986

ABSTRACT OF DISSERTATION

TIMING AND SPACING CRIME IN THE URBAN ENVIRONMENT:
LEXINGTON-FAYETTE COUNTY, KENTUCKY - 1985

Recent efforts in urban geography have sought to incorporate the time dimension into spatial analysis. While a number of different approaches have been utilized, most can be collapsed into two fundamental contexts: one-directional change and repetition.

Although less frequently used, the cyclical nature of time is quite different from the sterile, positivistic notion of time as a homogeneous variable in a physics equation. The identification of daily and weekly activity peaks offers some promise of escape from the nighttime bias of census data, and this study extends that analytic approach to include all hours of the day and all days of the week.

The central thesis of this study holds that time, in its cyclical sense, creates distinct space-time landscapes, and that discrete time blocks translate into usable analytical aids for the social/behavioral scientist, and

effective management tools for those who must apportion scarce urban resources.

Crime events are plotted over time to determine the pattern for eight crime types, and hours of the day are collapsed into six statistically significant four-hour "time slices." Matrices with 312 Space-Time Units (52 census tracts x 6 time slices) and 364 (52 x 7 days of the week) Space-Day Units are formed. Regression analysis is used to test the significance of traditional socioeconomic predictor variables in explaining the variance among crime rates within the Space-Time and Space-Day Units.

The time factors are then added to each equation as categorical variables, and the regression analyses are repeated to determine the increased explanatory power attributable to the time dimension. Noteworthy results include an increase in explained variance from 38.1 to 57.8 percent for assault, with discovery that two time blocks (19:00-23:00 and 23:00-03:00) are more potent predictors (based on BETA weights) than are the traditional socio-economic crime correlates. Other time blocks prove to be similarly potent explainers of property crimes.

It is concluded that the use of space-time units is a straightforward and valuable addition to the range of techniques available to academics and urban officials who seek

to optimize the provision of a wide array of basic urban services.

Robert C. Ham

1 May 1986

(Date)

TIMING AND SPACING CRIME IN THE URBAN ENVIRONMENT:

LEXINGTON-FAYETTE COUNTY, KENTUCKY - 1985

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Crime geography is one of those developing subfields that mandates a multi-disciplinary approach. This research is certainly no exception. I am deeply indebted to Drs. Stanley D. Brunn and Carl G. Amrhein, Department of Geography, for their frequent counsel at both ends of the Humanist/Positivist spectrum, and to Dr. Richard R. Clayton, Department of Sociology, for befriending a total stranger from an allied discipline. I have come to realize that, more often than not, philosophical differences between our disciplines revolve more around questions about the scale of inquiry and less about substance or direction.

The study would have been impossible without the willing and able assistance of the Lexington-Fayette Urban County Division of Police. Chief John P. McFadden, Asst. Chief Timothy C. Scully, Captain Frank Smith, Lieutenant Michael Delaney, Ms. Baxanna McClure, Officer Sandy Devers, and Mr. John Blackwood could not have been more gracious in their hospitality and complete cooperation in answering what must, at times, have seemed like endless questions. Theirs is a thankless task executed with true professionalism.

A special thanks is also due to Jim Mueller, Lexington-Fayette Urban County Division of Computer Services for his assistance in converting the incident data to a usable medium, and to Bob Crovo and Lorinda Wang, University of Kentucky Computing Center, for their unflagging patience in a consulting role.

They also serve who only stand and wait--in this case for an occasional glimpse of father or husband as he shuffles between home, library, computer center, police station, or "the street." For my wife, Vicki, and the children the time has now come for rediscovery and enjoyment; I owe them this and so much more.

Lexington, Kentucky
April 1, 1986

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CHAPTER I

INTRODUCTION

The Problem

> Fear of crime and a desire of protection of property and person seem to be escalating and producing a fortress mentality that alters the way that people see themselves and the way they live their lives (King and Golledge 1978, 368).

Following the rapid increase of violent crime during the 1960s, a decade that saw a 176 percent increase in the United States, the rate of increase in the level of criminal activity reported to police agencies seemed to drop off. Total reported crime actually fell three percent between 1983 and 1984, and criminologists attributed this trend to an aging of the "baby boom" generation. Early returns for 1985, however, showed a three percent increase, the first since 1981, and the problem seemed to be caused by rising crime in the cities of the South and West. Media reports of the phenomena failed to mention established relationships between city size and population density, opting instead to focus on an absolute increase in the numbers of Index Crimes.[1]

The absolute rate remains one of the major domestic concerns facing this nation, and a strong "law-and-order"

orientation has become a popular and significant part of most recent national elections. Although crime rates expressed in a per capita sense may appear to have stabilized over the long term, the rate of urbanization continues to expose more of the population to areas of traditionally high crime incidence.

In this time of economic retrenchment, fewer resources are available to combat a plethora of "urban problems" that are, in reality, human problems that only appear more concentrated in the urban fabric. As James Q. Wilson (1970, 388) noted:

> Naturally, many people who use the phrase "urban problems" know perfectly well that the problems they have in mind are not to be found exclusively in big cities (or even in cities at all) or that the problems are in every case caused, or made worse, by the conditions of urban life.

The costs of dealing with the problem are staggering, and the advent of lost funding through reduced revenue sharing by the Federal Government exacerbates the situation. Thus in the 1990s and beyond, money from federal, state and local sources, that can be directed toward preventive social programs and remedial police programs designed to counter both the causes and effects of crime, will be scarce. The effective allocation of those limited resources would be enhanced by a better understanding of the temporal and spatial distribution of criminal behavior.

The majority of research on the intraurban spatial distribution of crime has been done in larger metropolitan

areas such as Chicago (Shaw 1929; Shaw and McKay 1931, 1942 and 1969), Detroit (Lottier 1938a; Bordua 1958; Ham 1976), Denver (Lee and Egan 1972), Indianapolis (Chilton 1964), St. Louis (Boggs 1964 and 1966), and Baltimore (Lander 1954). To date no comprehensive studies of medium-sized American cities have been noted in the literature, and only one scholarly study of Lexington, Kentucky has been found by this author. Phillips (1980) did examine the journey-to-crime phenomenon, but limited his investigation to juvenile delinquents in the city.

While these studies suggest certain continuities with respect to where the crime events occur, relatively little has been done to combine the spatial-temporal aspects. Aside from two recent works, one on seasonality and assault (Harries, Stadler and Zdorkowski 1984), and one on the use of time by suburban burglars (Rengert and Wasilchick 1985), geographers have not examined the time structures of deviant social behavior, particularly as it pertains to different types of criminal events that might result from different sets of motivation and opportunity characteristics. The central problem under consideration, that of making maximum effective use of limited numbers of personnel and equipment, is clearly a management problem cast in the dual contexts of time and space.

The Objectives

The preliminary objective of this study is to examine the findings of the existing body of literature regarding the spatial distribution of crime in metropolitan regions, and to see how well certain key relationships apply to Fayette County, Kentucky, a metropolitan region that focuses on a medium-sized city--Lexington. Establishing concurrence would strengthen the arguments for what has been an ecological approach to the study of crime in urban areas (Phillips 1972), as relates to the form and process of urbanization and the etiology of crime, while simultaneously eliminating city size as a concern.

The primary objective is to develop new techniques for display and analysis combining both the spatial and temporal aspects of the distribution of crime in a metropolitan region. Of particular interest is the variation in the distribution of different types of crime by time "blocks". It seemed both instructive and useful to "slice" the crime surface by time segments, be they hours of the day or days of the week. This ability to generate displays of spatially and temporally differentiated crime regions is well within the capabilities of many law enforcement agencies with the almost ubiquitous nature of the microcomputer. These displays could become the modern equivalent of the "pin map" that has for decades been used by police agencies to record and display locations of

incidents. It adds a high degree of flexibility and speed to answering the myriad questions that arise concerning the "where" of crime events, and the rapid response time of the computer can facilitate a sorting by time factors that was virtually impossible manually.

Operational Definitions

For the purpose of this study a medium-sized city is one between 100,000 and 250,000 in population. In 1985 the Lexington city population stood at 221,753 and the total county population was 239,178. With an area of 283 square miles it is the second largest city in the state and serves as both a county seat and a regional (some would argue state) center for commerce, education and entertainment.

Operational definitions of the Class I (Index) crimes to be used in the study are given in Appendix A. These index crimes are the most frequently reported crimes and theoretically provide a more accurate picture of the total crime in a given area. Homicide, rape, robbery, assault, burglary, larceny and auto theft are considered more serious than the Class II crimes, and thus have a greater effect on both the perception and the reality of the quality of life. These are the crimes reported to the FBI and form the basis for media reports on crime rate changes. The crime of arson was also included in this analysis. During the validation step (objective 1), analyses of types of crime were conducted in both population-specific (rates

per 100,000) and area-specific (rates per square mile) terms; the latter having been shown to display a better gradient effect for property crime in urban places (Ham 1976). Thus, for this and certain other types of analysis and display, serious crime (the umbrella term for all Index or Class I crime) is separated into two subdivisions: crimes against persons (or violent crime), consisting of homicide, rape, robbery, and assault; and crimes against property (property crime), consisting of burglary, larceny, and auto theft. Unless otherwise indicated, violent crime is reported as a population-specific rate (per 100,000) and property crime is given in area-specific terms (per square mile).

The Study Layout

Chapter II provides the reader with a review of relevant literature, from the fields of geography and sociology, as it relates to both ecology of crime studies and efforts to incorporate the time dimension into urban analyses. Chapter III presents the variables to be used in the study and structures a number of hypotheses relating to the spatial and temporal distribution of crime in Fayette County. Chapter IV introduces Fayette County through a series of maps showing political organization and socio-economic diversity, and explains the nature of the crime data used in the study. In Chapter V the study findings are reported via a series of maps and graphs that explore

spatial and temporal distributions, and regression equation results are analyzed with respect to the explanatory value of the time dimension. Chapter VI offers conclusions regarding the theoretical implications of the study, and advances several recommendations for both social/behavioral scientists and urban resource managers.

CHAPTER II

GEOGRAPHY OF CRIME LITERATURE

Geographical Bases of Crime Studies

Relationship to Geographical Theory

The marriage between geography and criminology in a study such as this should be patently obvious. In order for a crime to occur a perpetrator must have the means to do the crime, must have an opportunity to do the crime, and must be motivated to do the crime. The crime must "take place" in an environment that may or may not limit opportunity, that may afford a wide array of targets, and that may present obstacles that serve as disincentives. The spatial distribution of such "things" in the environment is far from uniform, and their presence waxes and wanes with the passage of time.

Consequently, theoretical applications in criminology generally focus on one of four elements of the problem: laws, opportunity, motivation, or location. The ecological approach deals directly with the question of location. Specific applications, either in terms of the distribution of opportunity (targets of crime), or motivation (socio-economic correlates of offender source regions) abound in

the literature. A review of such perspectives is provided in the next section. An understanding of human perceptions is critically important in analyzing existing attitudes toward criminal activity, and particularly with respect to what ought to be done to limit the problem. "Just as there is a general perception of who commits the crimes, so are there general perceptions of where crimes are committed . . ." (King and Golledge 1978, 368). This observation applies at many scales, and most individuals can express a generalized impression of high-crime areas in their country, their state, and most particularly, in thei :ity.

The "downtown" areas of an urban place are often perceived as "unsafe" and are recognized by police, sociologists, planners, and residents as "high potential crime areas;" but many crimes occur in the suburban areas as well, and property crime is also to be expected in the higher economic districts of the city where many attractive targets for burglary are found. To the individual police officer this perception of a generalized "crime gradient," radiating outward from the Central Business District (CBD) and interrupted by frequent outliers, is based on an almost daily data update. Several larger police departments (e.g., Detroit, Denver, and Atlanta) are turning to spatial analysis to aid them in teasing more detail from the data, and to facilitate rapid recall and display in an attempt to allocate their scarce resources more efficiently.

Theoretical Aims of the Study

This study is an attempt to describe functionally how one might go about answering the "where" and "when" questions regarding criminal activity in a metropolitan region, and how that answer might be put in a form useful to decision makers. Recognizing that these spatially fixed events do not occur in a vacuum, certain spatial and socio-economic variables are examined to determine if established relationships hold in the case of the medium-sized city of Lexington, Kentucky. The effort here, of course, is to enable one to explain event occurrences based on these variables, and to anticipate criminal activity on current and future urban landscapes. By extending the heretofore demonstrated relationships from larger metropolitan areas to a medium-sized city, the use of Lexington as the target region of choice for the primary objective of the study should prove more palatable to scholarly critics.

Recognizing also that police activities are becoming more specialized--a necessity in dealing with ever more sophisticated criminals--an effort is made to determine the difference in spatial distribution of crimes by type. We know that the motivating factors (passion, need of money to finance a drug habit, peer pressure, etc.) in crime tend to affect populations that are segregated within the urban fabric; so too are the opportunities (targets, lack of barriers, etc.) to commit the crime. It follows logically

that the end result of the collision of motivation and opportunity factors should create a mosaic of criminal events of various types that can be mapped.

Certain of these types of crime can be limited somewhat by proactive efforts (as with physical security efforts to prevent property crime), others (particularly the more violent and spontaneous crimes) are largely a reactive challenge to police, but may imply proactive intervention by social service agencies. An understanding of the causal linkages may also benefit land-use planners in an attempt to avoid concentration of a socioeconomic mix that may serve as a catalyst for trouble.

The temporal element is added as a concession to reality; police resources are not infinite, and the allocation of those resources occurs both temporally and spatially in response to demand. Any ability to generalize and anticipate that demand can only serve to improve efficiency. While the long-term trends (seasonal) are more evident in the literature, there is little that can be done from a management perspective to ameliorate or react to them. Fixed manning is not easily juggled seasonally. This observation does not apply to daily and weekly cycles, however, and it is here that the police manager has the most flexibility to respond to an identified problem.

Torsten Hagerstrand laments our inability to handle ". . events as located and connected within a compact

space-time block" (1973, 73). Yet, in an attempt to do just that, geographers have looked at the time variable itself in a number of different ways. Yi-Fu Tuan (1978, 7) distills time's multiple meanings into two basic contexts: one-directional change and repetition. It is the second of these contexts that is the focus of this paper.

Certainly the one-directional change character of time has been important in geographical analysis. Uncounted regression models have incorporated the value of some variable at time "T" as meaningful input in predicting its value at "T+1." And if, in fact, the purpose of this study was to estimate the overall crime rate at some future time, then it might be a useful construct.

The focus of this study, however, is the utilization of a geographic information system upon which the efficient spatial and temporal allocation of finite police resources can be made--regardless of the overall rate encountered. The objective is to capture that essence of time that is meaningful in the opportunity-motivation paradigm of the criminologist.

Further discussion of the psychological aspects of time is contained in the last section of this chapter, however one day in a squad car will convince the reader of the difference, for example, that the diurnal cycle of light and dark makes in the urban environment. The fact of the matter is that most police officers are aware of these

spatial and temporal variations in a general sense, but human recall is both biased and incomplete. The development of crime-specific surfaces, displayed and analyzed in terms of the dual axes of time and space, should be achievable given the reasonably priced and available data processing capabilities.

Qualifications

This study admittedly looks at only a portion of the police services pie. Traditionally only about twenty percent of the calls made to police by the public deal with crime-related events (Lundman et al. 1978). Planning for the provision of police services must deal with everything from the mundane aspects of traffic control for athletic events to the high-visibility response to violent crime. Stanley Vanagunas recognizes three spheres of planning for the delivery of urban police services. The first is performed by local, regional and state criminal justice planning commissions, under Title I of the federal Safe Streets Act of 1968, as amended; an activity that is tempered by the "anticipated level of federal assistance which represents a small fraction of total police expenditures" (Vanagunas 1982, 37-8). The second is that internal to the police department itself, dealing with administration and operation. Its link to the first sphere cannot be severed entirely, as the internal organization of forces may wax and wane with the influx of state and federal

dollars. This is particularly true of specialized services targeted by crime type (such as crimes against children) which are normally initiated with a specific grant or funding proposal. The third category of planning is generally performed by some planning agency, central to the municipal government, that is charged with development of a comprehensive community plan.

It is toward the latter two spheres that this study is directed, recognizing that nationwide expenditures on police services represent about ten percent of the total municipal budget (Vanagunas 1982, 38). The county-level planner and the police chief must both participate in this broad-based planning challenge, balancing law enforcement needs against other police programs, and putting the entire police budget into context. In the broad view, then, one must resist the tendency to think in terms only of crime prevention and control. As Henry Goldstein observed:

> Viewing the police . . . simply as an agency of municipal government, elementary as this concept may seem, serves a number of important purposes. It puts to rest the argument that police functioning should be viewed solely within the context of the criminal justice function. It rids us of the notion that the police are a legal institution created with functioning strictly defined by statute, and substitutes in its place a more flexible concept of the police as an administrative unit of local government. And it contributes toward challenging the widely held belief that dealing with crime is the sole function of the police . . . (1977, 33).

This implies, also, a recognition of the fact that the major consumers of police services are not the "law-

abiding citizenry" to be protected from violence, but rather the victims, complainants, and other helpless individuals. Increasingly this means the urban poor who are disproportionate consumers of police services in metropolitan regions (Davidoff 1965).

The Spatial Pattern - Shrinking the Scale

Sectional and Regional Treatments

19th century exploration of the spatial distribution of crime was largely a European phenomenon with Guerry (1833) and Quetelet (1842) in France, and Rawson (1839), Mayhew (1862), and others in Great Britain leading the way. Much of this early work was at the national scale and focused largely on interregional differences. While there was some sporadic work in America during the early part of this century, little of it was done by professional geographers. It was not until the second half of this century that geographers, either alone or in an interdisciplinary effort, began to talk about the subject in earnest and started to debate the merits of various approaches to studying and analyzing this urban ill.

A representative sample of national treatments by social scientists includes Lottier (1938b), Shannon (1954), Harries (1971), Kowalski et al. (1980), and Georges-Abeyie and Harries (1980) who examined the distribution of crime in the U.S. by states or sections of the country. The mid-1970s also saw a philosophical debate over positivist

approaches extended to crime geography as Richard Peet and Keith Harries (among others) squared off via The Professional Geographer.[2]

The Urban Influence

While there arose an awareness of the myriad variables affecting regional differentiation as a result of these examinations, the unavoidable conclusion was that a greater proportion of the variance could be explained by urbanization:

> The total crime index rate in large metropolitan areas (1,782 per 100,000) is nearly two times higher than the rate in other cities (996) and about three times higher than in rural areas (568). In each of the seven offenses used in the crime index . . . this direction of decreasing rates from standard metropolitan statistical areas to other cities to rural areas is evident except for murder and nonnegligent manslaughter, which has a rate of 3.5 for smaller cities, compared to 5.4 for SMSA's and 5.1 for rural areas, and for forcible rape, which is 5.4 for smaller cities, 13.7 for SMSA's and 8.3 for rural areas (Wolfgang 1970, 272).

In further support of the general observation, Wolfgang notes that the anomalous trends for rape in rural areas are not consistent over the history of crime reports and should not, therefore, be considered as significant. It occurs to this reader that disincentives for reporting rape in smaller cities (everybody knows everybody else!) may also play a role in the figures presented.

Intercity Differences

Brantingham and Brantingham note that variation in city crime rates is as apparent in the 1980s as it was in

the 1820s, with equal application of the conclusion to Europe and America (1980, 93). Such differences were examined in terms of social structure as measured by employment and occupation mixture. They cited a body of criminological literature which follows three distinct modes of thought: intermetropolitan ecology, criminal motivation and criminal opportunity. A fourth perspective, that on the laws themselves, is tangential to the focus of this study and is therefore not reviewed in detail here.

Early conclusions of the ecological school were that variations in poverty levels, education, urban size, and economic specialization had a differential effect on interurban crime rates (Quetelet 1842, Morris 1958). Ogburn (1935) and Schuessler and Slatin (1964) determined an inverse relationship between crime and the percent of work force engaged in manufacturing. This factor relates to the "social disorganization" model of crime which holds that criminal motivation varies inversely with the ability of a society to integrate individuals into its own social structure in terms of socioeconomic roles and laws.

Standard Metropolitan Statistical Areas were examined by Eberts and Schwirian (1968), and patterns consistent with the "relative deprivation" theory of criminal motivation were found. This theory posits that emotional frustration is created at the spatial interface between deprived minorities and the "haves" of society. Subsequent

studies by Harries (1974) employed more rigorous statistical techniques to explain interurban crime rate variation. He found that ethnic and income factors were the best explainers of differences in violent crime, while city size and percent employed in manufacturing served better to explain the overall crime rate (which is, of course, numerically dominated by property crime). His later studies (1976a and 1976b) explored 1970 crime rates of 729 incorporated municipalities, constructing social indicator typologies of high- and low-crime cities. He too suggests that employment and occupational patterns (the "work ethic") might prove useful in explaining differential distributions of crime (1976a, 380).

The opportunity theory of criminal behavior makes motivation to commit the crime an assumption, and examines the distribution of targets, victims, witnesses and police in social space to explain observable patterns of crime phenomena (Baldwin et al. 1976). Sarah Boggs (1966) applied this theory to an examination of crime rates in St. Louis, using rates that were recalculated on a crime-specific "risk" base that took concentrations of victims and targets rather than standardized resident counts. C.R. Jeffery, in his Crime Prevention Through Environmental Design (1972), also applied opportunity theory spatially in a planning context.

Capone and Nichols (1976) related criminal mobility patterns to the unequal distribution of opportunity within the urban fabric. Brantingham and Brantingham see the mobility factor (as it differs from place to place) as the conceptual bridge between intraurban patterns and the interurban crime rate variation, maintaining that "economic and occupational patterns are known shapers of intracity mobility" (1980, 96). Their study, conducted at the SMSA level, combined mobility and other opportunity concepts in seeking to explain intercity variation. Economic specialization data were used to index potential opportunity structures, and socioeconomic data were used to index potential motivational structures. In the aggregate, murder and assault associated with motivational variables, while property crimes (including robbery) associated with opportunity variables. Rape associated with both (1980, 105).

Irrespective of era of study, urban crime rates in the United States in general do seem to increase with city size, but the controlling influences seem to be more related to demographics than to the factor of sheer size alone. Some significant relationships noted by King and Golledge are presented below.

1. Increased unemployment is associated with increased property crime.
2. Higher summer temperatures from city to city are associated with increases in crimes of violence.

3. Increases in the proportions of both the young and the old from city to city are associated with decreases in crime rates.

4. Japanese and children of foreign-born persons are associated with lower crime rates than average, while the percents of non-whites and foreign born are related to higher than average rates.

5. Increased population density is associated with a decrease in crime, which contradicts many of the qualitative predictions that are made (King and Golledge 1978, 368).

The last observation seems to be a rather restrictive interpretation of the data, and certainly runs counter to the majority of publications on this point. Different interpretations can accrue given "resident" versus "transient" populations within urban areas, as well as between categories of crime that relate differentially to residential versus commercial areas. King and Golledge were, however, looking at intercity differences, and controlling for the myriad other variables that can come into play while one looks at population density is difficult at best. One approach, of course, is to look at intracity variation, the next scale of examination.

Intracity Differences

Not only do big cities have more crime (Hoch 1976 and Herbert 1982, among others), but within those cities crime has been shown to be concentrated at the center. The percentage of stores which were the scene for a robbery or burglary was shown to decrease regularly with distance from the center of the city in the case of Chicago (Sutherland and Cressey 1966, 188-9). Shaw (1929) and his co-workers

found that there was a considerable variation in both rates of offenses and offenders among areas within the city structure. An examination of the concentrations of the residences of delinquents displayed an inverse relationship with distance from the center of the city. This gradient aspect of crime from the Central Business District (CBD) out to the suburban area and beyond is an objective reality, and its correlation with the population density gradient has been established firmly in the literature.

As early as 1931 Watts (1931) examined conviction rates (per capita) in Canada, and found that these also increased with population density over areas larger than cities. Similar findings were made concerning the city of Detroit and its "hinterland" (Lottier 1938a) for crimes against persons, and these findings were later updated for the Detroit region through 1970 with the gradient also verified for property crime when rates per square mile were utilized (Ham 1976). Similarly, Pyle (1974) found that criminal activity in the city of Akron has shown that people invariably equate the downtown and inner suburban areas with high crime rates. Findings such as this lent support to development of a general theory suggesting that delinquency, as well as other community characteristics, was the result of processes common to most American cities, and that differential "delinquency rates reflected dif-

ferences in social values, norms and attitudes to which youngsters were exposed" (Dunn 1980, 7).

Explaining the Urban Crime Mosaic

Social Structure Characteristics

In contrast to the previously mentioned theory of "social disorganization", a number of researchers in the social sciences have examined the association of delinquency with more specific indicators within society. "Neighborhood" or social structure characteristics have been shown to play a large role in the variable distribution of delinquency and crime within the urban fabric. Shaw and McKay (1942, 141), in their now classic study of Chicago, concluded the following:

> 1. Rates of delinquency and adult crime went down as one moved out from the city center.
> 2. Zones with high rates of truancy from school also had high rates for juvenile delinquency and adult crime.
> 3. High crime/delinquency rate areas were characterized by physical deterioration, declining population, high density, economic insecurity, poor housing, family disintegration, transiency, conflicting social norms, and an absence of constructive, positive agencies.
> 4. The areas with the highest rates in 1930 were the same areas that had been highest in 1900, despite the fact that the ethnic composition of the population had changed greatly.

Thus Shaw and McKay synthesized a number of factors that have been examined by sociologists, in a spatial context, as part of the "ecological" perspective on criminal behavior. The specific studies cited below tend to focus on three general types of measures: socioeconomic

status, family stability, and ethnicity. That these factors are strongly interrelated should be obvious.

Socioeconomic Status

As has been mentioned, a relationship exists among areas of high crime occurrence, low median family income, and low education levels. Lander (1954) sought to find stronger indicators of the socioeconomic variety, and did so using percentage of nonowner-occupied housing and of nonwhite population. A number of other studies have attempted to either replicate or refute Lander, but generally speaking areal measures of both crime events and criminal residences have been related to socioeconomic status indicators. Dunn (1980, 15) summarizes that education (median school years completed) and home ownership (percent of owner-occupied dwelling units) are most highly and negatively correlated with crime occurrence. Median family income also displayed a negative relationship. The degree of relationship also varies with respect to the type of crime under consideration. Schmid (1960a) found that areas of nonresidential burglary occurrence were not related to median family income or ownership-occupancy factors, but still retained a slight relationship to median income.

Family Stability

Ferdinand (1964) found a strong relationship between urbanization and the percent of delinquents from "voluntar-

ily broken homes" (this in contrast to rural homes which were more likely broken involuntarily). Schmid (1960a) used the percent of persons fourteen years of age and older who were married as his measure of marital status, and found that it exhibited a strong negative association with most of the individual offense variables.

Quinney (1966) looked at percent of females in the labor force as an indicator of the extent to which traditional family patterns exist, and at percent of population age fifty and over. These variables related moderately to selected offense types but not to others. Correlations of the percent of women in the labor force with homicide (Pearson's r = +.41), forcible rape (r = +.38), and aggravated assault (r = +.38) were significant, whereas correlations with robbery and other property crimes were not. Although the relationships among delinquency, marital status, and broken home variables emerge, Dunn (1980, 16) cautions about interpretation in light of multicollinearity of the areal indicators and construct validity.

Ethnicity

As indicated above, a number of crime studies highlight the interrelationships among crime rates, low socioeconomic status, and nonwhite populations; however, most also concluded that ethnicity exerts an additional influence on the distribution of crime that is independent of socioeconomic status. Willie (1967) analyzed the dif-

ference between white and nonwhite areas with respect to the influence exerted by socioeconomic variables and family stability variables on the distribution of delinquency. In areas that scored low on both stability and socioeconomic status, white or nonwhite, delinquency was the highest. In those areas of high socioeconomic status, however, the role of the stability indicator was a much more potent predictor of delinquency for the white areas. By contrast, delinquency was higher in the nonwhite, low socioeconomic status areas than in the white counterpart regions.

Offense type was also found to vary with respect to ethnic factors. Chilton (1967) found that children of predominantly black tracts of the city were proportionately less frequently involved in auto theft, however they were overrepresented in the categories of assault, robbery, disorderly conduct, and carrying concealed weapons. White children were more likely to be charged with the "softer" crimes of trespassing, truancy, vandalism, curfew violations, liquor violations, traffic violations, and running away. Both opportunity and motivation factors can be envisioned as playing a role in this selective process.

Three authors who used factor analysis of structural variables in an attempt to isolate relationships of racial composition with offense and arrest frequencies bear mentioning. Schmid (1960b), Boggs (1964), and Schmid and Schmid (1972) all found that ethnicity either (1) defined a

factor distinct from that upon which socioeconomic status variables loaded heavily, or (2) was related to a crime factor to which socioeconomic variables were not strongly related.

Relationship to Land Uses

The concept of relating crime incidence to land-use patterns within the urban fabric is an important one. Shaw and McKay (1942, 315) observed that "the rates of delinquents for many years have remained relatively constant in the areas adjacent to centers of commerce and industry, despite successive changes in the nativity and nationality composition of the population."

Lee and Egan (1972, 63) concluded that low nocturnal population, lucrative crime targets, and easy accessibility are some of the contributing factors to the strong positive correlation between high crime areas and proximity to the CBD. They felt that the degree of industrial activity, percentage of ethnic minorities, existence of thoroughfares, and extent of commercial activities were all associated with the CBD and with each other; each of the four contributed highly to explaining the spatial variation in the pattern of serious crime in Denver.

Dunn (1980, 13-14) summarized the distribution of crime in relation to land-use patterns as paraphrased below:

1. Crime event regions (as distinguished from criminal source regions) are more frequently found in the central and interior areas of urban places.

2. These are generally areas of high commercial activity, and adjacent high-density residential development is in relatively poor condition.

3. The quality of residential land as measured by inadequacy of plumbing facilities and need for repair is positively related to crime occurrence.

4. Different land uses are often related to specific offenses; differences in available targets or potential victims are often noted as a function of the activities or structure of an area.

Differential Distributions

In that the possible crime settings are diverse, and since various social activities (crime included) thrive under different conditions, several of the more obvious specific offenses are examined as they relate to both differential land use and socioeconomic characteristics.

Homicide

In their Cleveland study, Bensing and Schroeder (1960) found clustering of homicides in a relatively few areas. Sixty-two percent of the reported incidents of homicide in the county were concentrated in three of the twenty-eight study areas. Per capita rates within those

three areas were more than five times the city average for residents in the 18 to 59 age bracket. Although all three areas were contiguous central-city areas, they were residential as opposed to commercial areas. It should not be surprising to note that all three exhibited low economic status, great financial dependency, crowded housing conditions, population instability, social maladjustment, and poor health (Bensing and Schroeder 1960, 184).

Pyle (1976, 188) later identified a "crime concentration corridor" for the overall crime rate in Cleveland. Block (1976, 510) found homicide in Chicago to be so highly concentrated that a 375-block area representing only two percent of the city's blocks accounted for twenty-two percent of the homicides over a nine-year period. Similar findings pertain to Atlanta (Munford et al. 1976) and Houston where Bullock (1955) revealed that for a five-year period one area encompassing thirty-two percent of the adult population was the site for seventy-one percent of the homicides. He also found that, in a comparison of high- and low-crime census tracts, homicide varied directly with the racial composition of the population, unemployment, occupational class, and the physical deterioration of dwelling units, and inversely with median education level.

Robbery

Although involving the use of force and therefore regarded as a "crime against persons," robbery exhibits a

distribution different from that of homicide. In his study of Philadelphia, Normandeau (1968) also found robbery to be highly concentrated in the central city, however commercial and not residential areas provided the setting. This differential in the availability of the "object of the crime" was also recognized by Turner (1969) as the chief explainer of aggregation of robbery offenses in the center of cities. Schmid's (1960a) Seattle study supported the association of robbery with certain socioeconomic variables. Event regions correlated most highly with low median family income, low percentages of persons fourteen years and older who are married, high unemployment among males, and low median school years completed. In a factor analysis these variables loaded very highly with larceny, auto theft, and robbery on a factor which he identified as "low family and economic status." This factor explained a significant portion of the total crime occurrence in central Seattle.

Burglary

Although all burglaries are lumped together for purposes of reporting (to the FBI), burglaries are of two distinct types: residential and nonresidential. It was an analysis of these two separate categories that led Scarr (1973) to discover an additional temporal variable within the overall picture of burglaries in the Washington, D.C. area. Residential burglaries were found to be weekday,

daytime events, whereas nonresidential burglaries were largely nighttime and weekend events. Some suburban areas, such as Fairfax and Prince George's Counties, presented a mix of shopping centers and residences that made distinction of separate event regions difficult: but where residential and nonresidential land use is more segregated, as in the true urban areas, separate patterns emerged.

The clear implication is that burglars like to avoid running into people while they ply their trade, and thus the cyclic nature of workday America is a factor. Scarr's approach, virtually unique in terms of combining space and time factors in crime analysis, is a theme explored in more detail in the last section of this chapter.

Other Crimes

Schmid (1960b) noted a decrease in crime with distance from the center of Seattle, however certain offenses were distributed differentially. Check fraud, for example, was prominent in the central business district, however arrests of females for drunkenness were concentrated in "skid row" sections. Both were found to decrease outward radially. It is significant to note that female drunkenness is likely to be more widely spread than suggested above, but the probability of arrest of a suburban housewife who drowns her boredom in front of the daily soaps is much lower.

Journey to Crime

The differential impact of criminal mobility within the urban area is generally manifest in separate patterns for crimes against persons versus crimes against property. Rhodes and Conly (1981, 179) found that, in Washington, D.C., the median "commute" distance for robbery was more than twice that for rape (1.62 miles vs. 0.73 miles, respectively). Of course the availability of either type "object of crime" (the person or the goods) is greater for the urban dweller than for a rural counterpart, yet the occurrence of crime close to the place where the criminal lives is more likely for crimes against persons than for property crime, regardless of the degree of urbanization.

White compared distributions of crime events and offender residences in Indianapolis in relation to five independent variables, including "percent land used for business purposes." He found a general association between such land use and both residence and event locations in the case of felons (White 1932, 499).

In his homicide study of Houston, Bullock (1955, 572) found that forty percent of the victims and their assailants lived at the same street address or within the same city block where the homicide occurred. Although similar patterns of proximity applied to petty crimes against property in the urban setting, largely committed by juveniles, the suspected mobility limitations did not apply

as severely to those criminals committing the more serious property crimes such as burglary and larceny.

Normandeau (1968) discovered that robbery events were often in a census tract adjacent to the one in which the perpetrator lived. Similar findings were reported by Phillips (1980) in his Lexington study, and by Fabrikant (1979) who examined the spillover effect in Los Angeles. The latter two studies both used juvenile delinquency data for their analysis, and thus reflect what are likely to be constrained mobility options.

Turner (1969) advances a thesis of attraction to opportunities in the central part of the city to explain the relationship among both event and residence locations and socioeconomic variables. He also found that race was more potent in predicting high-offender residence areas than in predicting high-offense areas.

Despite the extended journey to crime for the more serious property crimes, there is still evidence to indicate that robberies and burglaries tend to be both directed against and committed by residents of the central city. In his study of Seattle, Calvin Schmid (1960b, 663) found that about forty percent of the burglaries and sixty percent of the robberies were committed in the central area, while over one third of the perpetrators of those offenses were residents of the same central area.

Rengert (1981, 189-201) combined the "at-risk" criteria of Boggs with relative accessibility measures to develop an opportunity structure model for examining burglary in Philadelphia. He extended the familiar gravity and potential models to account for spatial choice among alternative locations, then tested the model against objective measures of "attractiveness" and "emissiveness" when relative accessibility of areas was accounted for. He found that the number of residential housing units in an area was a fair indicator of attractiveness, but opted for further weighting by economic value. The number of burglars residing in an area was found to be a poor indicator for emissiveness, overestimating for central city locations and underestimating on the periphery.

The question of scale is an important one that, more often than not, differentiates the approach of the geographer from that of the sociologist. Still, expertise in spatial analysis is not exclusively reserved for the macroscale. David Herbert appeals for study of offender distributions at a variety of scales, down to the homes of individual offenders. His argument is a humanistic one that "space itself has little independent significance and needs to be contexted in its social meanings" (1982, 100).

Adding the Temporal Dimension

Many Senses of Time

> Any region when studied in continuous time can be looked upon as an open but delimited time-space region which contains society and habitat, population and resources. Over the years, such a time-space region is affected by innovations which contribute to structural change . . and . . alter the daily and seasonal routines as well as the life-cycle content of the population (Carlstein 1978, 146).

Measuring and partitioning the time-space region is a difficult task that assumes a particular language to permit handling events interconnected in time and space. Attempting to do that, geographers have looked at the time variable itself in a variety of ways. As indicated at the beginning of this chapter, Yi-Fu Tuan's second characterization of time is relevant to this study. It is an effort to move away from the sterile, positivistic notion of time as a homogeneous variable in physics. It is more closely akin to geography as humanism (as opposed to science), and somewhat more difficult to describe.

> Cooperative or coordinated activity of some kind is necessary or at least facilitated by temporal judgements. The hunt begins when the sun has risen, when a horn is sounded, when food is scarce . . . (Doob 1978, 59).

Leonard Doob's discussion of the hunt argues that temporal judgements are passed in every society because men are always confronted with certain conditions (natural changes over which they have no direct control) that demand or at the very least facilitate such judgements. Yet the repetitious or cyclical nature of time is not so straight-

forward a concept for urban man. He has, to an extent that varies with class and means, insulated himself from its seasonal aspects (Orme 1978, 66). He is but peripherally aware of the concomitant vegetative changes, and spends much of his day in the protective cocoon of central air and heating. Nevertheless man, like the other living organisms, still experiences continuous repetition in a rhythmic form; the daily cycle of sleep-waking activities is but one example.

Discussing this "sense of time" begs yet another point of clarification. It is clear that man is influenced by internal biological rhythms of nature:

> Not only do body temperature, pulse rate, blood sugar and so on show circadian (daily) rhythms, the susceptibility to drugs, pain, stimuli, varies enormously throughout the day (Luce 1972).

Some of us are definitely "morning people", others work much more efficiently late at night. Shapcott and Steadman (1978, 73) draw a broad analogy with natural language--a socially evolving cultural product that is "independent of any single person's speech behavior." The language provides the structure within which a rich variety of writings and utterings can take place. The rules of the language, which in and of themselves are constraints, are precisely the mechanisms which permit diversity to be understood. "A similar observation applies to our cultural structure of time rhythms" (1978, 73).

The perspective of an individual investigator might be on analyzing individual behavior (motivation factors per se) that is influenced by internal rhythms. Alternately, it might be an ecological perspective on the urban environment that includes external factors that might shape response rhythms. The orientation of this study is toward the latter.

Chapin (1978, 13-14) examines constraints to activity choices, observing that specialization and the division of labor are structural bases of contrasts that lie deep in the industrial and post-industrial society. He views the "micro-level of daily routines" as the essential starting point for analysis of the nature of activity systems (1978, 14). This is particularly relevant to this study which attempts to merge criminology and urban geography. Some of those external elements of the environment very clearly relate to opportunity factors: the cover afforded by darkness (specific blocks of time), or the confusion created by a noisy crowd at a shopping mall on Saturday. Others may relate to motivation factors: the poor ghetto mother who needs medicine for a sick child.

Chronogeography

Parkes and Thrift (1980) discuss "paraspace" as a form of N-dimensional social or economic space, developing a utilitarian space-time metric of distance and interval. On a three-dimensional cube of northing, easting, and time,

they examine the possible relations that might occur between two time-space points, identifying simultaneous, sequential, and durational identities. They lament that normal applications simulate additional dimensions by posing a series of overlays (ethnic, social, physical status) to examine the social-space/physical-space intersection. They propose a multi-faceted view of time to provide the necessary linking arguments for the overlays, and dub it "chronogeography."

In building this concept they examine both locational and experiential aspects, establishing an entire language of their chronogeography. They occupy themselves with the very real problems of identifying, labeling and measuring events in time-space. Consider, for example, the subtle differences between "sequence" (a b c d A B C D a' b' c' d'), "cycle" (a b c d a b c d a b c d), and "recurrence" (a x b c x d x e f x). The lexicon of the time geographer must include "phase" (relative position in a cycle), "pulse" (interval between periodic recurrences), "duration", and "relaxation time." Circadian (daily) and greater periodic cycles must be recognized and compared to others. Are they synchronous? Harmonious? What particular key events are "pacemakers" or "markers" in their impact on rhythmic activities? Over how large an area are these impacts felt?

Parkes and Thrift also emphasize the essentiality of time in realization of place, and repeat Tuan's (1978, 13) assertion that "people are more interested in narrative than in static pictures" of reality. The many senses of time, however, confound the issue, as universe (clock) time, life-times (relational, biological), and social times impinge on often discontinuous events. Lynch (1972, 120) observes this discontinuity, noting that "we are suddenly a year older."

Space-Time Budgets

A number of authors have recognized the potentialities and limitations of research into individual activity patterns. Anderson (1971) displays an application of sampling in the space-time construct with his discussion of space-time budgets in household surveys. Such information can be useful for deriving "behavioral" postulates on which geographic themes of spatial structure might be based, and for planning spatial structures to suit the behavioral patterns and aspirations of individuals and households (1971, 353). His particular sense of time is clearly that which defines an axis of the "space-time continuum," and he seeks to discern temporal regularities that are inherent in spatial patterns. The assumptions of such an approach are twofold: (1) that time is one-directional, and (2) that time is equitably distributed for allocation.

These space-time budgets involve recording the use of time for a given period, including the spatial coordinates of activity locations. Anderson notes that others have used such information for determining quality of life (Meier 1962), the impact of choices on values (Chapin and Hightower 1962), and constraints imposed by urban environments (Hagerstrand 1972). Such diaries have the potential to uncover the marked regularities of daily human behavior. These regularities are felt to be shaped by the response of the human organism to three types of constraints: physiological, physical, and social.

Compared to other available data forms, the use of the space-time diary is highly preferred. Data collection and analysis, however, are made difficult by several factors. There is generally a three-day tolerance for maintenance of comprehensive data. Once the data have been collected, each individual activity must be geo-coded, a laborious procedure. Because of inherent mobility biases by classification, samples must be carefully stratified with respect to age, occupation, residential location, and household composition.

Perhaps the most difficult aspect of such studies is the challenge of dealing with the two distinct types of language together. According to Anderson (1971, 357) we can distinguish between a substance language and a space-time language. The latter is a notation that locates a

given activity in four-dimensional space (three if the vertical aspect is ignored) which includes time. The substance language is aspatial, and speaks to the characteristics or properties of respondents. Anderson laments the confusion over analysis in light of these linguistic differences, citing Hagerstrand's modeling of "outer limits" to behavior (1971, 358) as an example.

He summarizes that the more common response to space-time data sets has been to abstract from them (usually with a bias toward one or the other language), and to proceed with one or more separate analyses. This simplification has generally followed one of three courses:

1. Collapsing the coordinate-locational language into a substance form. This tends to submerge the organizational aspects of activities--timing, sequence, and spatial location--and aggregation of populations by group or area take on a "commodity expending" characteristic with respect to time.

2. Timing and/or sequencing of activities can be made explicit, while their spatial organizations are not. Such an approach may examine sequences of activities and their associated probabilities of occurrence at various times of the day.

3. The spatial organization of activities can be examined, but the temporal arrangement ignored. Variations

in activity intensity, over the entire period of interest, could be mapped so to display their spatial variation.

It is this synthesizing of both languages that so frustrates Anderson, who notes that "obtaining comprehensive summary measures of the overall pattern (including sequencing) in space-time budgets remains a major problem" (1971, 358). He notes that one such approach to derive a comprehensive measure might be a factor analysis approach.

Factorial Ecology

One particularly interesting approach to the problem is that of Taylor and Parkes (1975) in which they used a matrix of eight specific times during the day (discrete nodes of anticipated activity peaks) multiplied by ten geographic areas to generate eighty space-time units (STUs). Some twenty-two variables representing activity and travel data were applied to the eighty STUs and the 22 x 80 matrix yielded eight significant factors. These factor scores were then mapped for the eighty STUs. Taylor and Parkes found a distinct temporal variation in the spatial patterns of: class segregation, bright-lights entertainment, journey-to-work, age-group segregation, and workday cycles.

Hanham (1976) faulted the Taylor and Parkes effort on two counts. First, the structuring of eighty STUs in advance of the factor analysis (22 x 80) was essentially an application of a two-mode analysis to what was a three-mode

problem. He advocated use of more sophisticated techniques (his application was of INDSCAL, a multimodal factor analysis program), and applied them to Taylor and Parkes' data. Hanham's study, however, revealed broadly similar results, was still able to derive only two significant dimensions, and the multimodal factors are more difficult to interpret.

His second criticism found that census areas provide valid socioeconomic indicators for only a very restricted time of the day--the nighttime. Given the virtual absence of a comprehensive alternative to the census data, this is a criticism that can be levelled against most ecological efforts. Interpretation of results, therefore, must be tempered with an understanding of the nighttime bias.

Goodchild and Janelle (1984) used space-time diaries as sources of input for developing a space-time factorial ecology to explain distinctive diurnal patterns in the city's social geography. They echo Hanham that while homogeneity exists in neighborhoods during the nighttime hours, ecological mixing during the daytime creates a different cultural landscape for the city (1984, 809). Certain societal rules and institutional practices tend to regulate the interplay between individual patterns and social structures. Obvious examples include the eight-hour workday, observation of the Sabbath, public transportation schedules and public school calendars.

Following the lead of Taylor and Parkes (1975), they developed a series of 192 space-time units (STU)--32 pseudo census tracts at six observation times. The times chosen were to represent peaking of certain common activities: Sleeping (0200), Morning work (0910), Lunchtime (1215), Afternoon work (1500), Early evening discretionary time (1900), and Late evening discretionary time (2230). Goodchild and Janelle were particularly careful to avoid bias in their sample for this study. From a universe of 380 census enumeration areas in Halifax, they randomly selected sixty-eight. Households were randomly selected within each enumeration area in their proper proportion to the total number of households in the universe. Individuals within those households were selected so to replicate the aggregate characteristics of the metropolitan area. Finally the thirty-two Pseudo Census Tracts (PCTs) were structured around the core sixty-eight enumeration areas in a manner that maximized internal homogeneity while providing coverage of the entire area.

A socio-demographic description of the STUs was generated from some 1561 single-day, space-time diaries--a device that permitted them to sample ecological mixing in the urban fabric. Individual patterns are interwoven with the societal rules and institutional practices as well as with the patterns of other individuals. They then used a principal-axis factor analysis to identify the underlying

dimensions of the 192 STUs on some 40 variables, and mapped the resulting factor scores.

Obviously interpretation of the results is difficult given the complexity of the procedure, however this seems always to be the trade-off in terms of "blending the languages" as Anderson had advocated. The ability to communicate results of such a study is critical, and Goodchild and Janelle developed a visual device for describing the temporal fluctuations of the various factors (standardized) at each PCT.

The eight most significant factors explained 91 percent of the variance in the resultant patterns. The most effective factor was that related to employment (29.2 percent of the variance). In examining the changes in the intensity of certain factors over time, it is clear that certain classes are more affected by institutional "shapers" than are others. Their space-time diary data, arrayed in a factor-ecological manner, describe diurnal changes in a dynamic urban structure. Obviously census data neglect such diurnal variations.

Clearly space-time activity patterns are made less complex by such a treatment, but there are limitations. The authors call for more investigation into the criteria for defining viable space-time units of analysis. The limited longitudinal extent of such an approach also implies that certain periodicities in the data may be

overlooked. Nevertheless the findings of this and other studies do suggest that we need to reevaluate our current theoretical views about the city as described by "snapshot" census-like data. The authors conclude that "to the extent that diurnal temporal patterns in the spatial coincidence of activity types and sub-populations are identifiable, causal factors are suggested" (Goodchild and Janelle 1984, 818).

Path and Project

Thrift and Pred (1981) view time geography as a powerful and flexible tool suited to a number of approaches in contemporary geography. In planning for our use of space and time, we are aware of the temporal and spatial availability of many options, and competition with the activities of others in a particluar locale. In terms of local "connectedness", they envision time demography, time-geographic connections, and life-path analyses (sense of place and identity) as appropriate applications.

The concept of path also fits well with a Marxist/ Humanist perspective in a "path and project" approach where, as Pred later points out (1982, 163), individual paths and institutional projects intersect at a specific spatial and temporal location. Such an approach might enlighten us as to the "means by which the everyday shaping and reproduction of self and society, of individual and institution come to be expressed as specific structure-

influenced and structure-influencing practices occurring at determinate locations in time and space" (Pred 1982,163).

Time geographers, no matter what the stripe, seem to be concerned with this "path and project" notion, seeking to describe the dynamic nature of the constant coupling and uncoupling of individual "paths." This conceptualization seems best suited to urban planning, particularly in such areas as public transport and provision of basic services. Lenntorp (1978, 178) used simulation modeling of "individual activity programmes" in an attempt to optimize the marriage between structural constraints and individual preferences.

Time Ahead

Time and space seem inexorably linked, and thus they are ripe for continued investigation not as isolated antagonists but as a wedded pair. It seems that accurate description of the third (or fourth) dimension will require some sleight of hand, some handy device to permit the human mind to merge the languages of location and temporal "being." Perhaps refresh graphics and massive data storage and manipulation capabilities will become primary and not just "gee whiz" modes of information sharing. Some form of factorial ecology seems to have the geatest potential for acceptance among the "quantifiers," while time notions that affect a "sense of place" are alluring to the humanist. Between the two there will likely always be the issue of

scale--the argument between the general and the particular--to both fuel debate and extend horizons. Time geography appears to be a subfield ripe for exploration, and "unless they [space, place and time] are taken together the geographer's world will retain an air of unreality, abstracted from life as lived, which no synthesis confined to the facts of space and location can remove" (Tuan 1978, 16).

Time as the Third Dimension

The thesis here is that time, in its cyclical sense, creates distinct spatial landscapes, and that those environments can be differentiated by blocks of hours during the day or by days (or groups of days) of the week. Adding such time "slices" as another dimension to the analysis and display of crime data holds promise for facilitating resource allocation to the extent that crime occurrence influences such decisions. The major contribution of this study to the body of geographical theory is simply stated: Cyclical time slices can be used to define significantly different crime surfaces in urban environments. It speaks directly to finding a solution to Torsten Hagerstand's lament--just how can we add the temporal dimension to a study of urban landscapes? This is the challenge of a relatively recent thrust into "Time Geography."

Summary

This chapter has provided a review of the geographical and sociological literature as it pertains to the ecological approach to criminal behavior. The scale of analysis of the locational component of crime was reduced to the intraurban level, and a number of social-structure and land-use variables were seen to play a role in the differential distribution of crime rates within the city. Further, this distribution was examined with respect to specific crime types and was found to vary both locationally and with respect to different sets of those crime correlates. Finally, the ability to introduce a time variable into the analysis, such as the use of a space-time unit in x,y,t space, was explored.

Chapter III will set the stage for the analysis of the distribution of crime in Fayette County, Kentucky, by structuring a series of hypotheses. These hypotheses approach the problem in terms of spatial distributions, temporal distributions, and a combined spatiotemporal analysis of the several crime types.

CHAPTER III

STRUCTURING THE PROBLEM

Setting the Stage

The research to date suggests that different crime rates and different types of crime can be associated with different land-use patterns and social characteristics when aggregated spatially. For the most part, past efforts have concentrated on the larger metropolitan areas where crime data existed in greater abundance. More sophisticated quantitative techniques (e.g. Corsi and Harvey 1975) continue to support similar conclusions regarding the basic correlates of crime.

If the relationships between social structure characteristics, land-use patterns, and crime rates which many authors have noted are indeed valid, then the distribution of crime within medium-sized cities, in relation to those factors, should apply generally, irrespective of city size. Additionally, although several studies have examined the way in which different types of crime relate to specific neighborhood characteristics, no comprehensive effort at mapping these differential surfaces of criminal activity in a form useful to police agencies has been noted.

Finally, the further differentiation of the above into a combined spatial/temporal framework is almost without precedent in the literature (see Reed 1980). Seasonal approaches have been implemented, however weekly and daily cycles have not been differentiated with respect to crime types. Space-time unit analyses have focused on peak activity times, rather than providing for around-the-clock coverage; yet it is this latter approach which would seem most useful to social/behavioral scientists and police administrators.

Data Requirements

Dependence upon the Uniform Crime Reports (UCR) as the principal source of crime information is almost universal, but not without limitations. Application of separate state penal codes to a set of crime definitions, given the existence of some fifty-two jurisdictions of the United States, is something short of uniform and implies limits for interregional utility. The validity of their use has been debated (Robison 1966; Lejins 1966), however the UCR remain our best source of quasi-standardized crime data.

The evidence also indicates that much crime is never reported to police either because the crime is not detected (such as fraud, vandalism, and embezzlement) or because of concealment by the victim or perpetrators. The obvious crimes in this latter category include solicitation,

prostitution, adultery, sodomy, rape, desertion, gambling, and the like (Sellin and Wolfgang 1964). Also:

> Federal crimes are generally not included in the UCR, and rules governing commerce and industry, laws concerned with unemployment and social security benefits, although carrying legal sanctions when violated, are usually handled by administrative agencies (such as the National Labor Relations Board or the Securities Exchange Commission) rather than by federal district courts (Wolfgang 1970, 280).

Additionally, the collection of crime statistics by some 9,000 separate agencies, compiled locally for input to the UCR, must surely reflect variation in administrative capabilities, practices and professionalism. Not all crime that is reported to the police is properly entered into the statistical base. Changes in administrative procedures, personnel, and more recently, automated data processing (ADP) systems, can affect recording accuracy and efficiency within a given jurisdiction.

It should be noted also that the crime index offenses are set apart from nonindex offenses, implying that they are more serious; yet certain of the nonindex crimes, such as assault and battery, arson, and kidnapping can result in serious physical injury, and others, such as forgery and embezzlement can involve significant monetary losses. It is understood, however, that the index crimes are chosen to provide an "index" of overall crime, and they do correlate well with the total crime rate in a given area.

Statistically, in a criminal episode that involves multiple offenses, only the offense that is highest on the

FBI list of index offenses is used for coding the episode for input to the UCR. Thus, as Wolfgang (1970, 281) explains: "If an offender commits forcible rape, burglarizes the house, physically injures the victim to the point requiring hospitalization, and steals the victim's automobile, only the rape is counted."

For these reasons local data, which provide a finer grid (at the census tract and block-code level), and have not been "smoothed" to fit the reporting requirements of the FBI (multiple records for multiple offenses arising from the same episode) are required. A complete discussion of the data set provided by the Lexington-Fayette Urban County Division of Police is presented in Chapter IV.

Socioeconomic data are available from the decennial census and, despite the aforementioned limitations of such data, they represent the most reasonably available data set for comparison with the crime data. In an analysis that seeks to examine the degree to which time data "enhances" the explanatory power of the known correlates of crime, a stable base from which to advance is mandatory. Selection of the census tract as the basic unit of analysis provides a finer grid than does a focus on police precincts or beat areas, and it avoids the problem of further apportioning census-like data to these larger units.

Finally, the selection of census tracts, which in themselves are designed to present some degree of

homogeneity within the urban fabric, facilitates the use of land-use data which is generally available from local planners. The first set of hypotheses is designed to validate the Fayette County region as a study area which, in terms of the correlates of crime, resembles those larger regions mentioned in the literature review section.

Variables and Hypotheses

Census tracts within Fayette County were used as the unit of study for crime data input. The technique for investigation of conclusions reached regarding larger metropolitan areas is the multiple regression of the form:

$$Y_n = a + b_1X_1 + b_2X_2 + \quad . \quad . \quad . \quad b_nX_n$$

where Y_n's are the dependent variables, X_i's are the independent variables, and the b_i's are the regression coefficients.

The dependent variables, Y_n, are the various crime rates to be investigated. Rates were determined for those Index crimes that fall into the crimes against persons category (homicide, rape, robbery, and assault) and separately for those that are termed property crime (burglary, larceny, and auto theft). These two subcategories are in addition to the offense-specific rate calculations. Past experience has shown it to be counterproductive to compute a total crime rate given the numerical dominance of property crime in the total crime figure. As mentioned

earlier, violent crimes are calculated in population-specific terms, whereas the property crime rate is area-specific (per square mile).

The independent variables were selected based on findings that were encountered consistently in the literature review, and thus they represent those which are expected to provide the greatest amount of explanation in the regression model.[3]

Demographic

X_1 - represents the residential population density. High crime rates have consistently been correlated with urban areas of high density. The opportunity for interpersonal contact is enhanced, and generally high densities imply low-income, slum, or ghetto-type neighborhoods.

Thus Hypothesis 1: Serious Crime Rates, Y_n, are positively related to X_1.

X_2 - represents the nonwhite proportion of the population. Most criminology studies have found that crime rates among minority groups are higher than the norm. Hypothesis 2: Serious Crime Rates, Y_n, are positively related to X_2.

Economic

X_3 - represents the median family income. Poverty and crime are popularly conceived as being interrelated, based on the conviction that the poor look to criminal

activity as a means to supplemental income. The strong correlation between income and education levels suggests that this variable also measures education to some extent. For that reason, a separate variable for education was not selected.

Hypothesis 3: Serious Crime Rates, Y_n, are inversely related to X_3.

Land Use

X_4 - represents the proportion of land area devoted to commercial activity. Presumably such commercial activity provides the opportunity for crimes against property and thus should be reflected in the property crime rates (larceny, burglary, etc.).

Hypothesis 4: Property Crime Rates, Y_n, are positively related to X_4.

X_5 - represents the proportion of land area devoted to industrial activity. Typically industrial areas are not popular residential areas for those who can afford to live elsewhere. They are habitually associated with low-cost housing, saloons, cheap restaurants, liquor stores, pool halls, gambling, and prostitution.

Hypothesis 5: Serious Crime Rates, Y_n, are positively related to X_5.

X_6 - represents the mileage of principal commercial thoroughfares in a given census tract. Actual mileages are scaled to the size of the census tract to give a measure of

the density of the transportation pattern. Such routes provide a measure of access and escape for the mobile criminal.

Hypothesis 6: Serious Crime Rates, Y_n, are positively related to X_6.

Distance

X_7 - represents the distance of the census tract centroid from the center of the Central Business District, taken to be the corner of Main and Limestone. This is the formal expression of the "crime gradient" phenomenon. The core of the city is the focus for many types of interaction, and traditionally crime has been no exception. Hypothesis 7: Serious Crime Rates, Y_n, are inversely related to X_7.

Identification of Crime Regions in Space

The second set of hypotheses for the study deals with mapping the locations of various crime types in an effort to discern significant differences in their spatial distributions. Identification of crime regions within the city, and awareness of the manner in which they differ from one another with respect to a particular type of criminal activity, provide useful tools to aid resource allocation decisions.

Hypothesis 8: Areas within the city can be identified which differ significantly from one another with respect to serious crime rates.

The significance of such differences can be tested using the Kruskal-Wallis one-way analysis of variance; a non-parametric test suitable for use on skewed data sets (See Appendix B). The distribution of Kruskal-Wallis approximates that of Chi Square, and it tests the statistical significance of the difference of mean ranks among the grouped data. Hypothesis 8 will be tested during construction of group intervals used to partition data for visual display.

Hypothesis 9: Areas within the city can be identified which differ significantly from one another with respect to the type of crime experienced.

Identification of Crime Regions in Time

Because different types of crime involve differing combinations of opportunity and motivation characteristics, peak activities of a particular type should register a distinctive temporal signature. Graphs were prepared to show the different "time slices" that characterize a given crime type. In deference to the need for resource allocation, time slices were aggregated into six four-hour segments, structured to maximize the significant difference between serious crime rates across the time groupings, again using the Kruskal-Wallis analysis of variance.

Hypothesis 10: Significantly distinct "time slices" of criminal activity by type of crime can be identified within the urban fabric.

Again, as with the spatial data, the Kruskal-Wallis measure will be used to "fine tune" the time groupings. The use of four-hour time slices provides a fine enough grid to detect a pattern, yet is well suited to the needs of the resource manager who must allocate personnel (usually on an eight-hour basis) to provide for around-the-clock coverage. The Kruskal-Wallis test is used to calibrate the partitioning into four-hour blocks (03:00 to 07:00 versus 04:00 to 08:00?), ensuring that the six blocks ultimately chosen represent the most statistically significant difference of means possible. Hypothesis 10 will be accepted if the construction effort is successful (statistically significant).

A similar effort is made to identify days or groups of days of the week which constitute peak activity periods for the various crime types.

Hypothesis 11: Activity within crime-type regions differs significantly by day of the week. Group means for days or groups of days, by crime type, are compared to determine the significance of the differences.

Using Space-Time Units in Analysis

The true utility of adding time to the equation can be measured by reexamining our ability to explain variation

among crime rates through the vehicle of regression analysis. Having established certain socioeconomic variables as reliable independent variables in the several regression equations, it remains to add the time dimension.

A number of sophisticated techniques were examined during the literature review, but it was desired to find a more direct method--one suitable for adaptation to a number of applications by social/behavioral scientists and for implementation by the law enforcement community. This use of time should lend itself to rapid sorting of data, clear display, and useful analysis. A straightforward approach to the problem which permits direct interpretation of results is utilized.

The fifty-two census tracts of the city are used to structure a space-time unit matrix that consists either of 312 rows (52 x 6 4-hour time slices) or 364 rows (52 x 7 days of the week). An initial set of regression analyses is performed using the most potent socioeconomic predictor variables for each given crime rate to form the columns of the matrix. Socioeconomic variables are constant over time for the fifty-two census tracts, whereas crime data are aggregated according to the time (or day) selected. These runs establish a "floor value" of R^2 for the regression equation for a specific rate.

The beauty of the approach is that it has the potential to verify the utility of reasonably available data

that requires no factor analysis or restructuring. The time blocks and days are also expressed as straightforward concepts that can be used to search the data base for display material.

The regression analyses are then repeated with the space-time and space-day identifications added to the matrix columns as categorical variables in binary form. To avoid creating a perfectly conditioned matrix, one of the four-hour slices (or at least one of the days of the week) is initially unspecified and thus collapsed into the constant term of the regression equation. The following two hypotheses are expressed:

Hypothesis 12: The addition of space-time units can enhance the predicting power of established crime correlates.

Hypothesis 13: The addition of space-day units can enhance the predicting power of established crime correlates.

In both cases the hypotheses are tested by examining the R^2 value returned by the regression equation in which all independent variables have been found to be significant contributors.

Summary

The study problem has thus been cast in terms of three broad objectives. The first of these is to test whether Lexington, a medium-sized city, behaves much like

its larger cohorts in terms of the traditional correlates of crime and intraurban distribution patterns. The second set of objectives involves mapping those patterns in space and examining their variation over time, by individual crime type. The final set of hypotheses seeks to determine the utility of adding time to the set of variables which has traditionally served to explain such distribution patterns.

Chapter IV introduces Fayette County through a series of maps showing political organization and socioeconomic diversity, and explains the nature of the crime data used in the study.

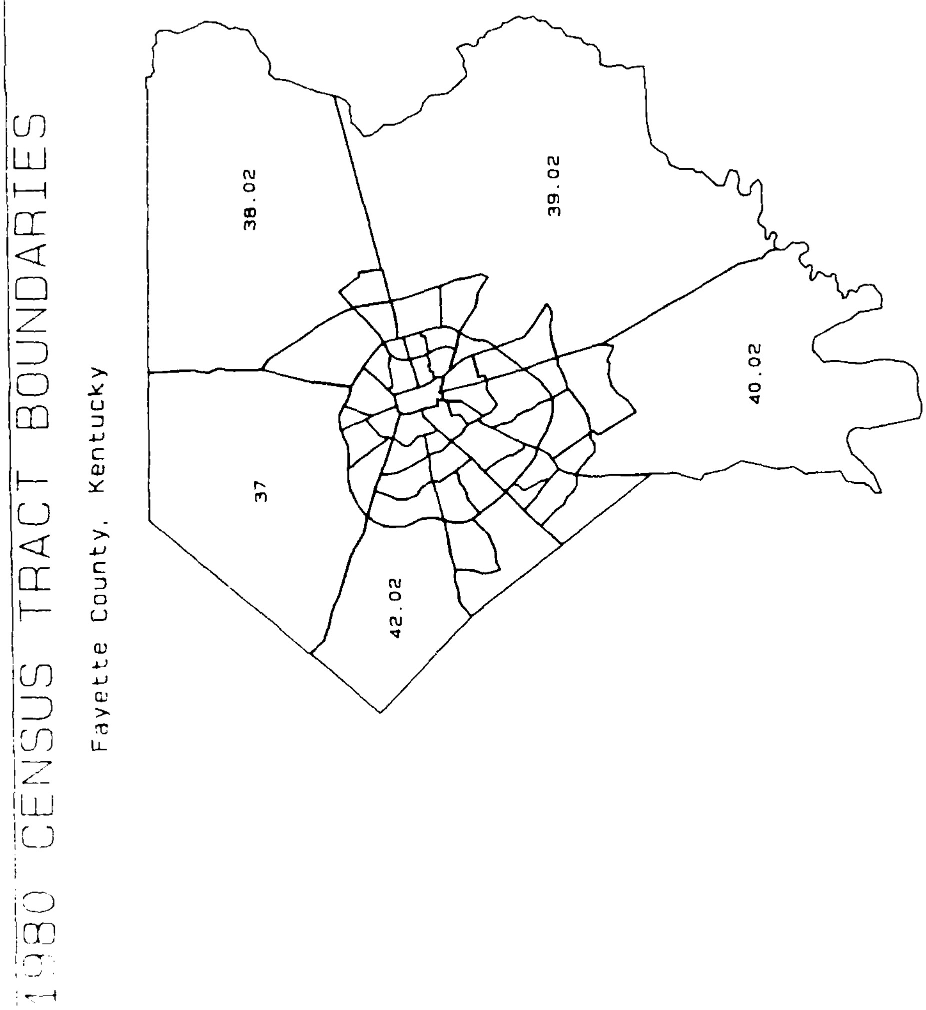
CHAPTER IV

THE STUDY AREA

Political Organization

For the 1980 Decennial Census of Population and Housing of Fayette County, Kentucky, data were collected on fifty-two census tracts. The outlines of these census tracts are shown on Map 1. Five of the peripheral census tracts have been identified on the map. These five tracts represent the largest and least urbanized tracts within the county. Because subsequent maps showing the distribution of phenomena within the county must show detail of the urban fabric, these outer tracts will be clipped along the margins. This permits a larger representation of the primary urban-suburban area, and does not result in a loss of significant detail. All rates calculated for these outer tracts are, in fact, computed using the total land area or population base, and only visual display is affected.

The boundaries of census tracts are, by design, placed so to maximize the degree of socioeconomic homogeneity within the tract, while at the same time following some readily identifiable feature. Tracts are designed in an effort to encompass an ideal population of about 5,000


1980 CENSUS TRACT BOUNDARIES
Fayette County, Kentucky
38.02
39.02
40.02
37
42.02

Map 1.

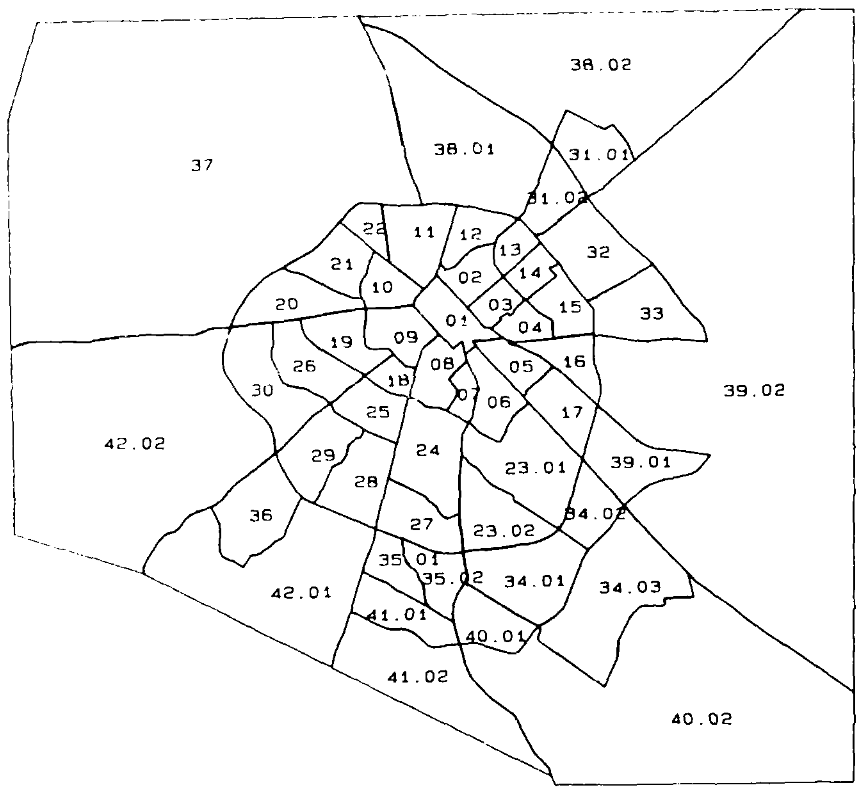
people, but some tracts within the inner city have grown well beyond that number. The "beltway" (State Highway 4), or New Circle Road, is evident on the map as it encircles thirty-one of the city's census tracts, and provides a handy point of reference for discussions that follow.

Map 2 provides a closer look at the census tracts, and labels all of them. This is the base map that will be used for all subsequent presentations. (A reference map showing major street names and neighborhood identifications is provided in Appendix I.) The smallest of these census tracts, tract number 07, is just over one-fourth of a square mile, while the largest, tract 39.02, is almost sixty-six square miles. Residential populations range from a low of thirty-four in tract 21 (a highly industrialized tract) to a high of 10,485 in tract 34.01 (a medium-density suburban housing area).

As mentioned earlier, the provision of motorized police patrols is but one part of a complex set of services that the Division of Police provides to the community. Many of the services associated with specific types of crime are not divided geographically, but rather functionally--extending to all parts of the county as needed. Such activities might include the special unit for investigating crimes against children, the burglary investigation unit, or similar task groups formed from within that capitalize on special skills, aptitudes and training.

1980 STUDY AREA CENSUS TRACT BASE MAP

Fayette County, Kentucky



Map 2.

The division of the county into beat areas is an attempt to provide adequate patrol coverage with limited resources. These are the police officers who (hopefully) provide high visibility deterrence and rapid response to crime. Map 3 displays the boundaries of the existing police beat areas (which are currently under review). It should be apparent that an effort has been made to follow existing census tract boundaries to create larger beat areas. In obvious recognition of the "crime gradient" effect, beat areas are smaller near the center of the city, and encompass fewer census tracts. Census tract 01 (The Central Business District--CBD) has been divided into two beat areas, 1A and 1B, only to be handled as a single beat area during slack time.

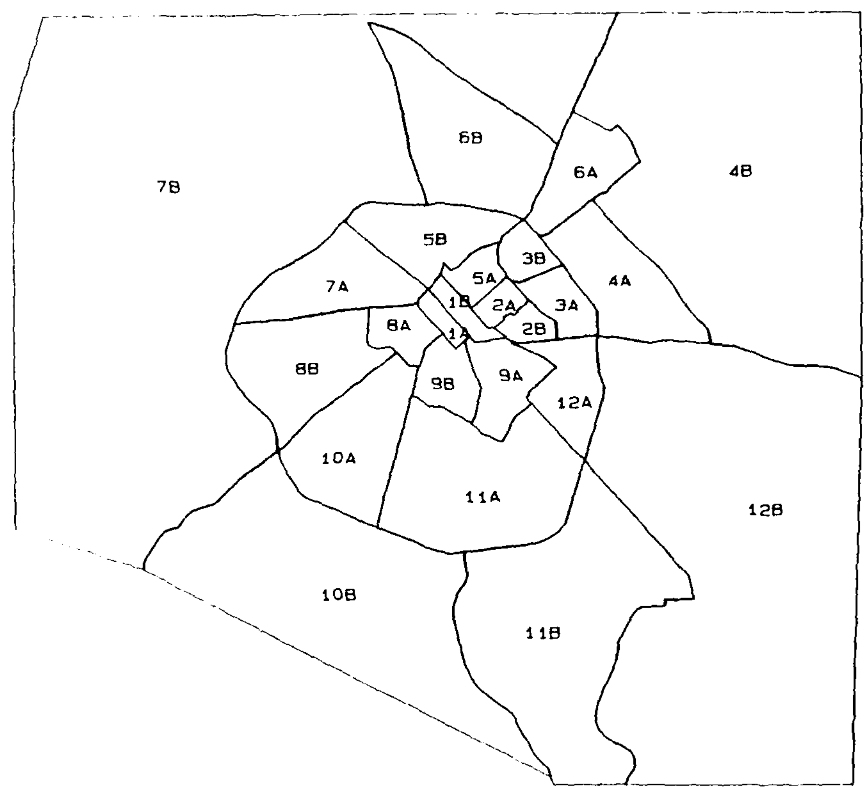
It should also be noted that numbered pairs (7A and 7B, 11A and 11B, etc.) are arrayed radially so that they can be handled as a single unit. It is obvious that such an approach ensures that a given patrol will be operating in an area that is less homogeneous than a census tract; but to attempt to group census tracts for homogeneity within the beat areas would defeat the logical purpose of balancing workload within beats, and would not likely facilitate rapid response and reinforcement.

Socioeconomic Diversity

The series of maps that follows is designed to paint a portrait of the county in terms of the variables that

1985 STUDY AREA POLICE BEAT MAP

Fayette County, Kentucky



Map 3.

were discussed in Chapter III. In working with any mixed data set, one must be cautious in partitioning the data, particularly when visual display is to be used. The socioeconomic data used for this study are no exception. Several of the socioeconomic variables and most of the crime rates are not distributed normally among the census tract areas. As a result, use of the mean as a measure of central tendency and the allied standard deviation was avoided. Instead, non-parametric statistical tests were used to both govern partitioning of the variables and to test the significance of resultant distributions. The Kruskal-Wallis test, discussed in Appendix B, was found to be most useful.

The median and inter-quartile deviation were computed for each variable, and these values were used to partition the fifty-two observations into three groups: a central group with 26 tracts (50 percent), and high and low groups with 13 tracts (25 percent) each. Both the high and low groups were split again to yield extreme and moderate subdivisions such that the resulting "ideal" distribution would be as follows:

5 - Extremely High	Group 5
8 - Moderately High	Group 4
26 - Middle	Group 3
8 - Moderately Low	Group 2
5 - Extremely Low	Group 1

The data ranges were then inspected for natural breaks that would suggests movement of cases to adjacent groups, and

the validity of the groupings was checked with the Kruskal-Wallis test, ensuring that the group means were significantly different at the .05 significance level.

In some cases a sixth display category was added to show areas for which no data were available, large numbers of "zero cells" (especially with crime data), or singularly extreme values (group 6). The actual number of cases that resulted for each variable is given in table 1.

TABLE 1

CENSUS TRACT COUNTS BY MAP GROUPINGS
SOCIOECONOMIC VARIABLES

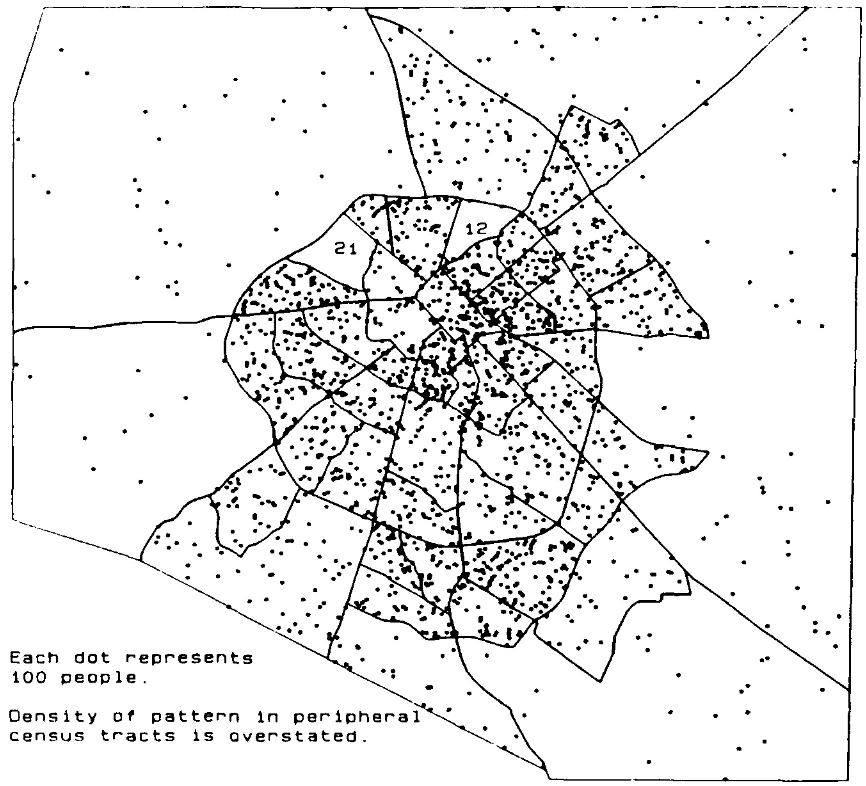
Variable	No Data	Zero Cell	Group Number 1	2	3	4	5	6
Population Density	0	0	5	8	26	8	5	0
Nonwhite Popn %	0	0	4	11	23	10	4	0
Median Famil. Income	2	0	5	7	27	8	3	0
Commercial Land Use %	0	0	5	9	25	9	4	0
Industrial Land Use %	0	25	0	7	9	8	3	0

Population Density

Map 4 provides a dot representation of the population density of the county. Census tracts 12 and 21 have been identified as they bear mentioning at this stage of the discussion. Census tract 21 is a highly industrialized tract with a 1980 residential population of only 34 people. Characterized by railroad tracks and yards, rock quarries, and earth moving equipment, this tract is an unwelcome

1980 POPULATION DENSITY BY CENSUS TRACT

Fayette County, Kentucky



Each dot represents
100 people.

Density of pattern in peripheral
census tracts is overstated.

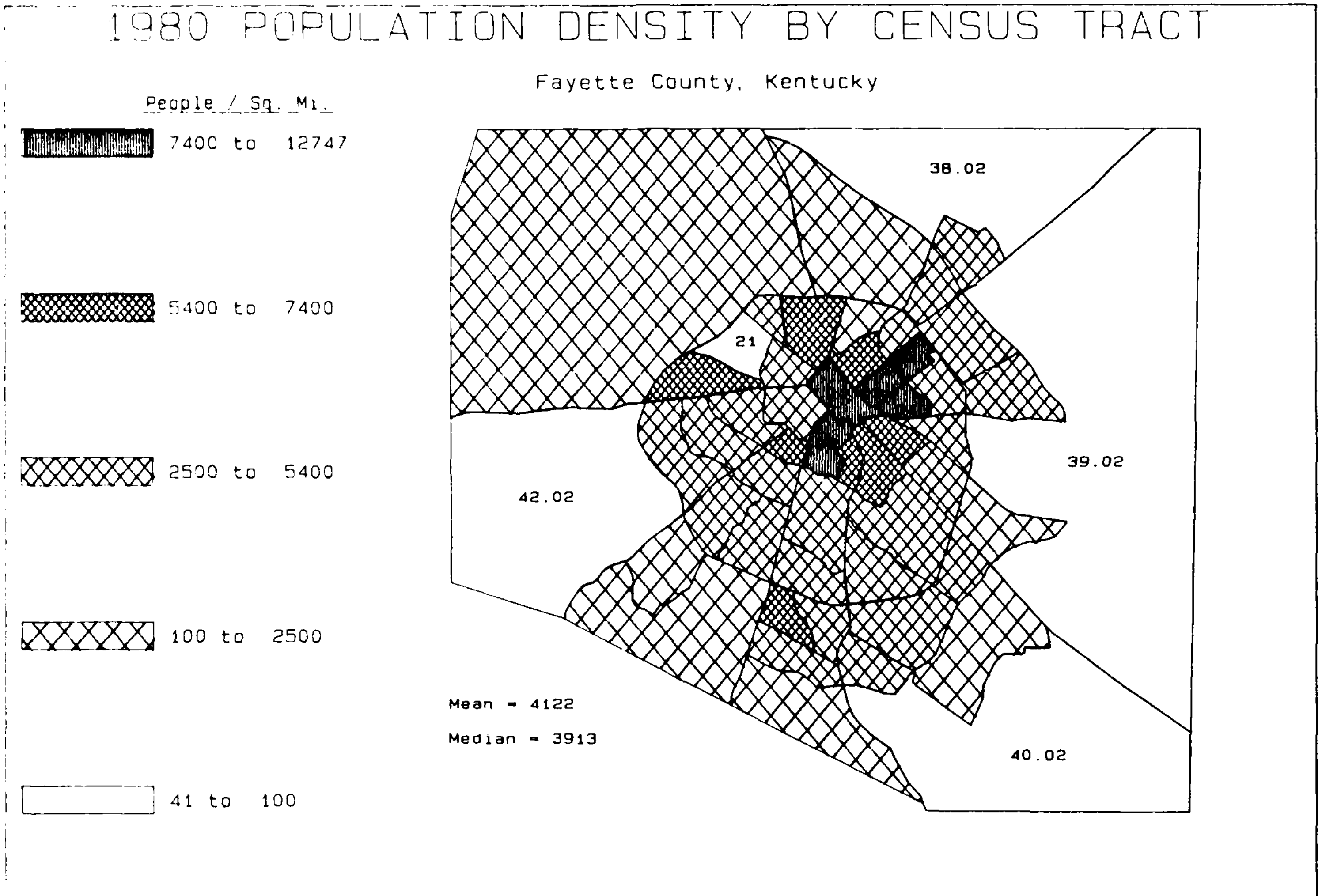
Map 4.

neighbor to Cardinal Valley and Viley Heights (tract 20) to the south. Tract 12, with a residential population of only 260 is home to the sprawling IBM plant, and thus affords many opportunities for human interaction.

The remainder of the pattern is better differentiated on map 5 which identifies the expected high densities associated with the CBD, including tracts 01, 03, 04, 08 and 14. Tract 08 is home to the University of Kentucky and much vertical development with towering residential structures; however the remaining tracts noted are traditional inner-city tracts of high density housing, in many cases older homes that now house multiple families.

The density decreases outward with New Circle Road providing a convenient point of reference. The high density tracts outside of New Circle seem to be in three general areas. The first of these is in the Northeastern sector, along Paris Pike and Bryan Station Road in what is referred to as the Eastland and Winburn areas. The second of these is a more recent suburban explosion in the Southeastern sector, between Richmond and Tates Creek Roads in Gainesway and Southeastern Hills. The third such area is a broad, generalized sector that extends from the Lexington urban area toward the Jessamine County Line (Southwest).

The existence of quality agricultural land on the periphery, particularly that devoted to raising horses, has served to limit suburban growth in other sectors, but the



1980 POPULATION DENSITY BY CENSUS TRACT
Fayette County, Kentucky
People / Sq. Mi.
7400 to 12747
5400 to 7400
2500 to 5400
100 to 2500
41 to 100
38.02
21
39.02
42.02
40.02
Mean = 4122
Median = 3913

Map 5.

advent of Man-O-War Boulevard, a second beltway outside of New Circle, promises to hasten the expansion of the urban area, particularly in the southern sectors.

Racial Composition

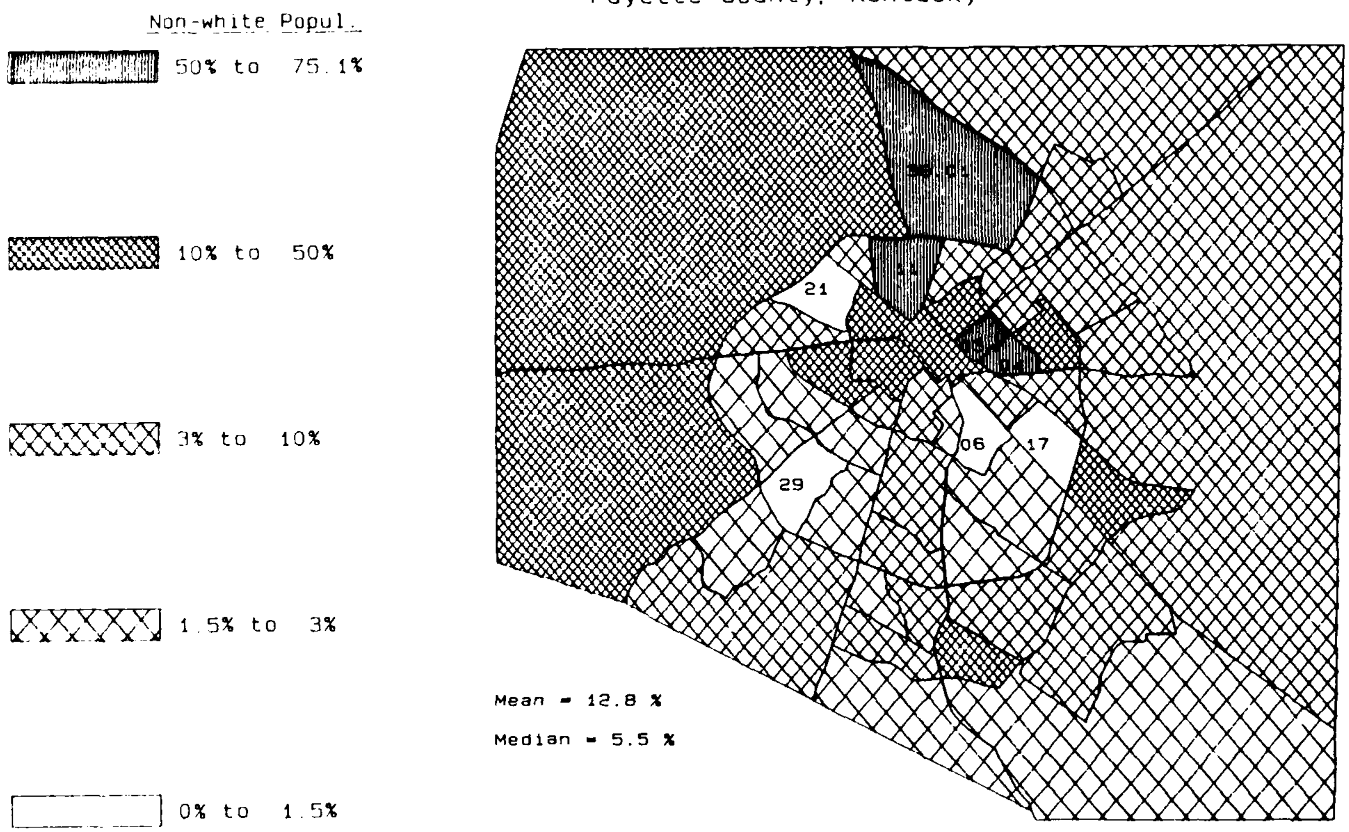
Map 6 supports an obvious conclusion regarding the racial segregation that is evident in Fayette County. The four tracts in group 5 have nonwhite population percentages of 75.1, 75.1, 71.3, and 66.7. When you consider the fact that thirty-eight of the fifty-two tracts have less than 10.0 percent, the map is even more astounding. It should come as no surprise to the student of urban geography that these nonwhite populations are concentrated in the central and near-central urban areas that have already been identified as having high population densities.

Economic Status

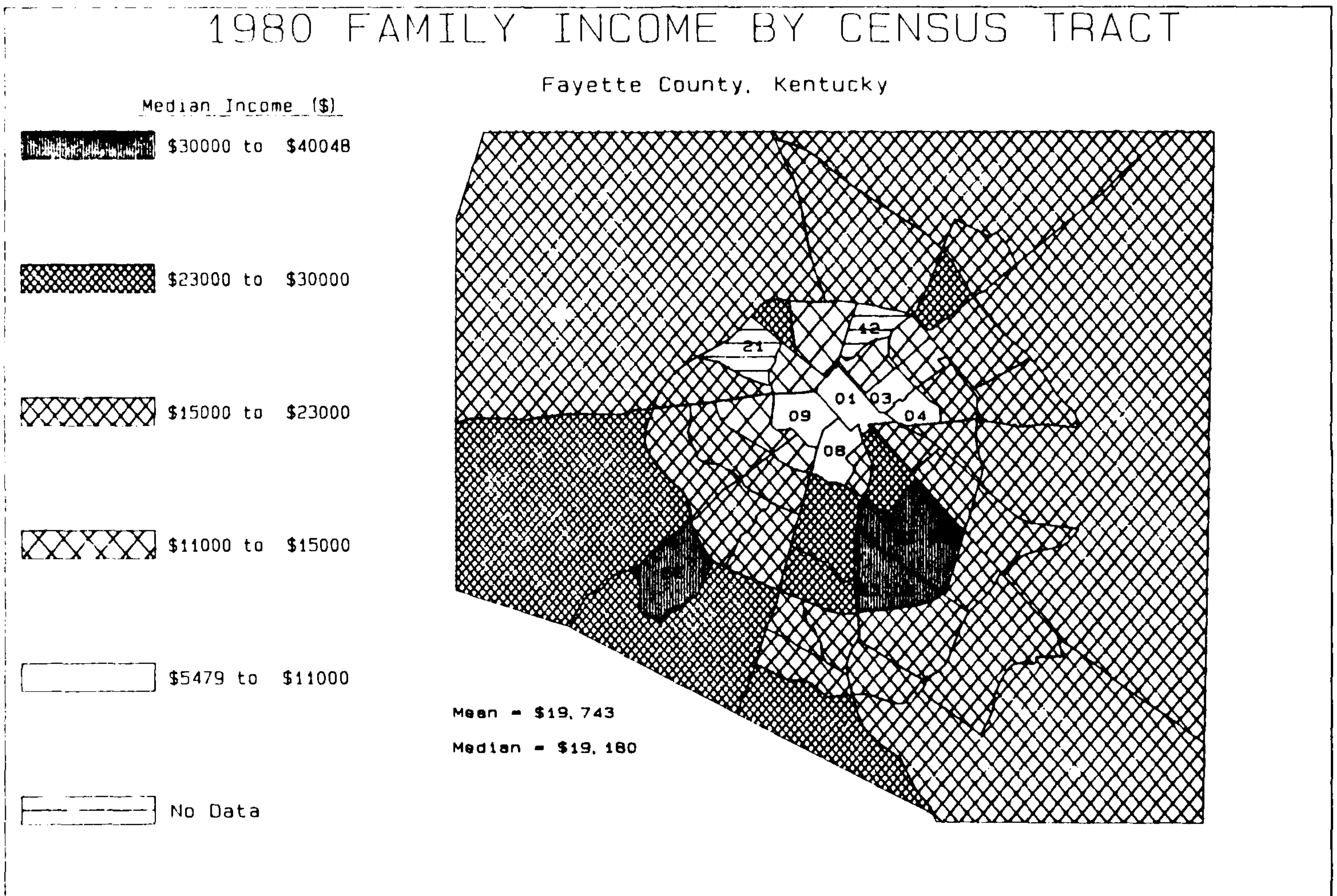
Given the preceding discussion one might venture a few guesses as to the geographic distribution of wealth within the county. Using median family income as a crude approximation of that phenomenon, there are few surprises on map 7. The downtown area is once again evident, particularly tracts 01, 03, and 04 (high density and high nonwhite percent of population). Added to this we also find tract 08 (the residents--students--are not often overpaid), and tract 09, a curious mix of industrial (paper and scrap metal recycling) and commercial uses.

1980 RACIAL COMPOSITION BY CENSUS TRACT

Fayette County, Kentucky



Map 6.


1980 FAMILY INCOME BY CENSUS TRACT
Fayette County, Kentucky
Median Income ($)
$30000 to $40048
$23000 to $30000
$15000 to $23000
$11000 to $15000
$5479 to $11000
No Data
42
21
01
03
04
09
08
Mean = $19,743
Median = $19,180

Map 7.

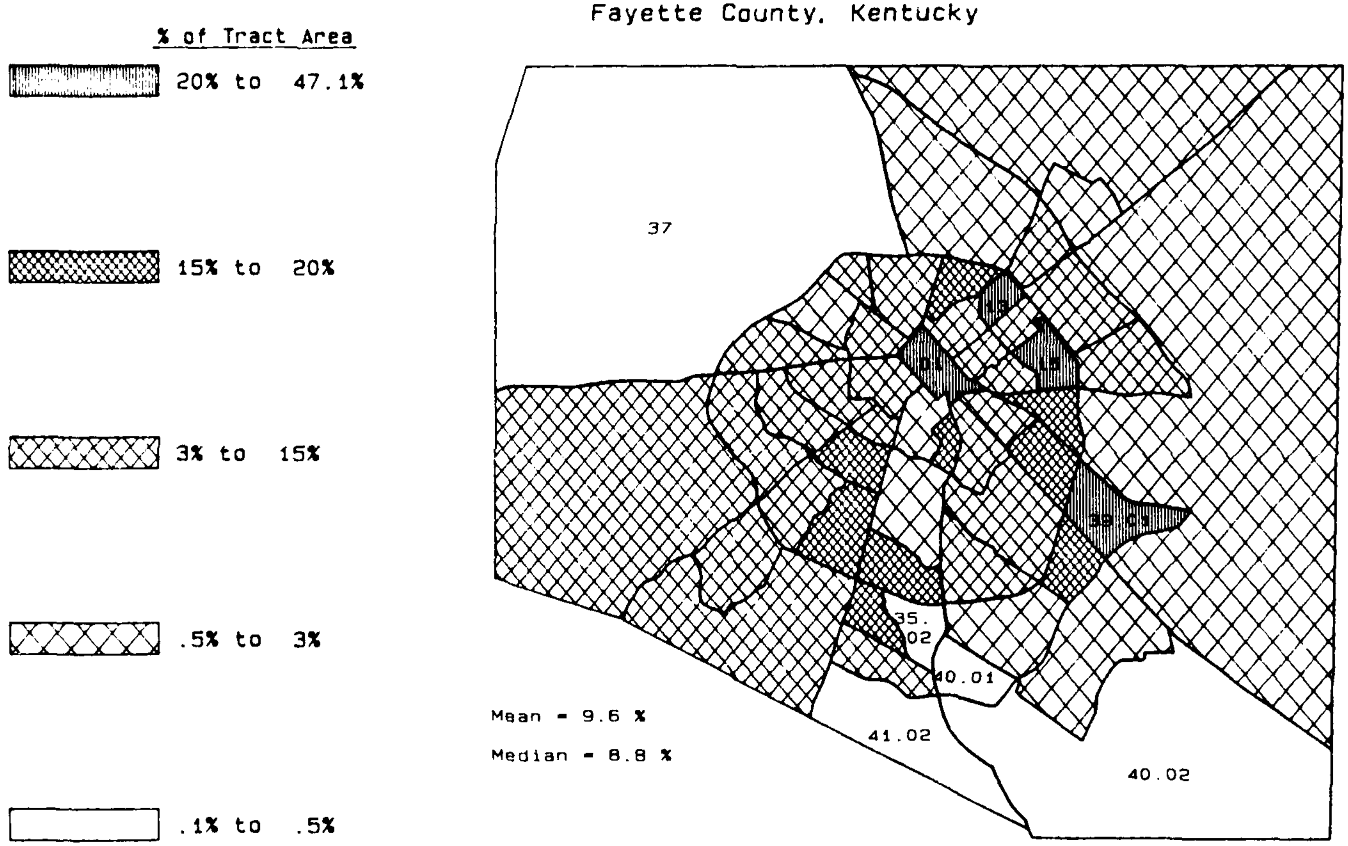
On the other side of the coin, the "haves" have established themselves in the south and southwest. Inside of New Circle the area is bounded by Richmond and Nicholasville Roads, and consists of six census tracts in the Lakeshore, Lakewood, Warrington Woods, Lansdowne Merrick core, and the Lansdowne, Shadeland, Crestwood areas. Outside of New Circle the area is more toward the south and southeast, but extremely high values can inflate Median Family Income in such areas as tract 42.02, where several wealthy horse-farm families live. Nevertheless there is a generally southerly preference in terms of new homes for the upper-middle class of Lexington.

Commercial Land Use

While the old central-city core of commercial activity is still evident in the land-use maps, the roles that New Circle Road, suburban developers, and the ubiquitous shopping mall have played in altering the structure of this city are evident in map 8. From Northland (tract 13) southeast on New Circle to the Shadowood area (tract 39.01), the four-thirty driver must run the gauntlet of stop-and-go traffic. This area is rivaled only by Nicholasville Road, visible on the map as the divider of four southern tracts in group 4, as it approaches what has become a much maligned intersection with New Circle.

1985 COMMERCIAL LAND USE BY CENSUS TRACT

Fayette County, Kentucky



Map 8.

Industrial Land Use

The influence of industrial land use, as shown on map 9, has already been evident as we reviewed the other distributions within the city. Zoning restrictions have ruled out industrial activity in a number of sectors, thus twenty-five tracts are displayed in the "zero cell," and only three are highlighted in the above 50 percent category. Tracts 12 (IBM) and 21 have already been discussed, and tract 10 is the inward extension of the tract 21 industrial area, merging only with commercial and some residential land use near the CBD.

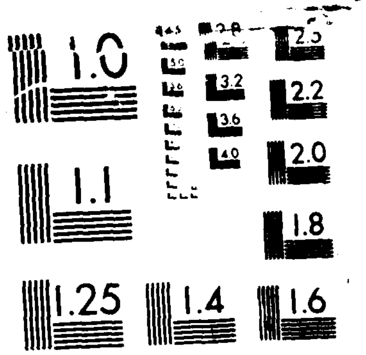
The second tier of tracts (group 4: 20 percent to 50 percent) can all be traced to two primary influences: railroads and tobacco. The four group 4 tracts in the eastern sector of the map all lie astride the old Louisville and Nashville line or the Chesapeake and Ohio. Two more tracts just southwest of the CBD (tracts 09 and 18), as well as the large tract outside New Circle (tract 42.01) warehouse tobacco.

Potential Trouble Spots

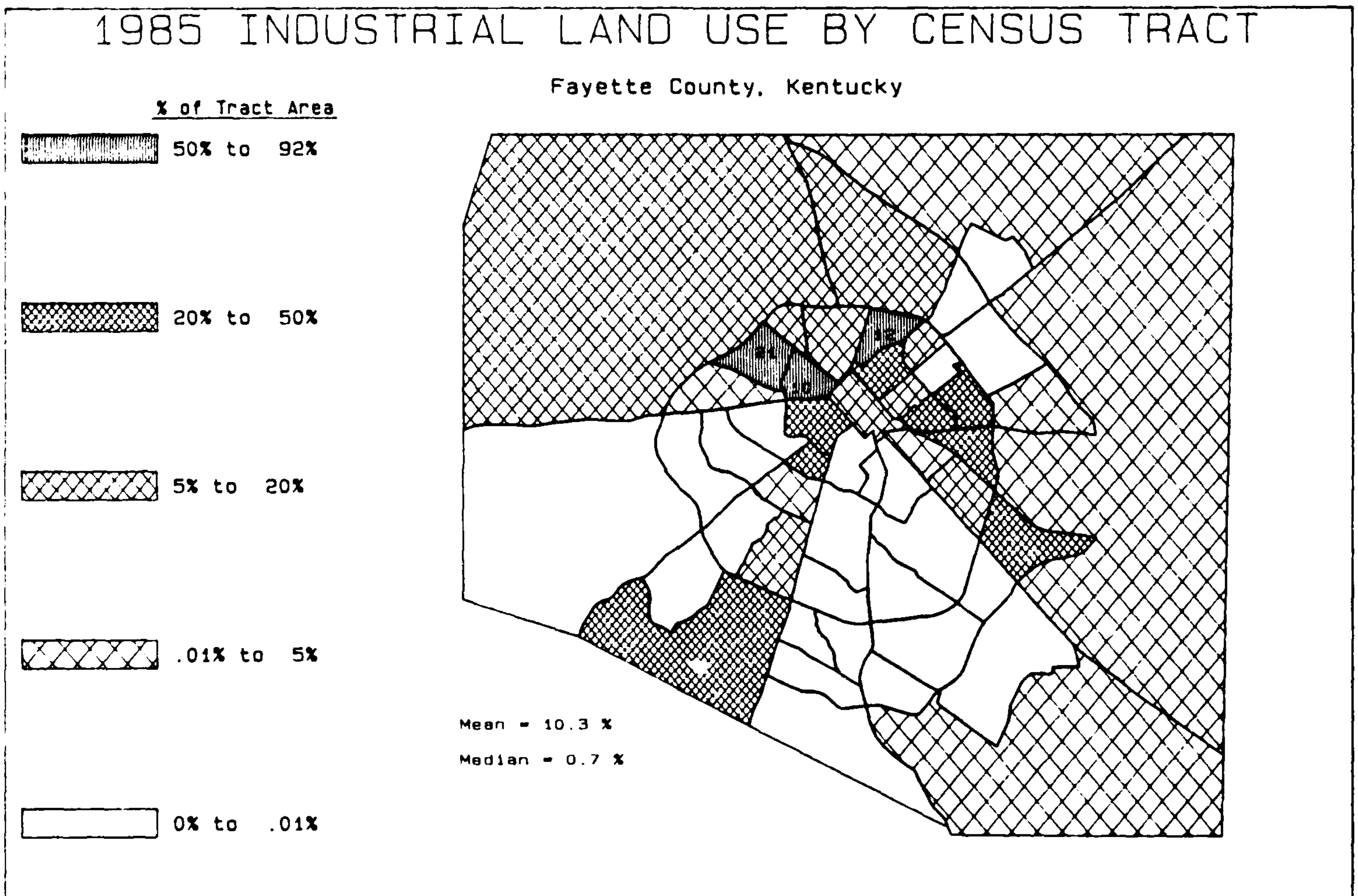
Based on prior observations about the correlates of crime, one can hazard a guess concerning potential trouble spots within the urban fabric. Table 2 examines the frequency with which certain census tracts fell within extremes of the groupings for the socioeconomic variables. Any tract falling within the upper quartile (group 4 or 5)

AD-A168 070 TIMING AND SPACING CRIME IN THE URBAN ENVIRONMENT: 2/3
LEXINGTON-FAYETTE COUNTY KENTUCKY - 1985(U) ARMY
MILITARY PERSONNEL CENTER ALEXANDRIA VA R C HAM

UNCLASSIFIED 01 MAY 86 F/G 5/11 NL



MICROCOPY RESOLUTION TEST CHART


1985 INDUSTRIAL LAND USE BY CENSUS TRACT
Fayette County, Kentucky
% of Tract Area
50% to 92%
20% to 50%
5% to 20%
.01% to 5%
0% to .01%
Mean = 10.3 %
Median = 0.7 %

Map 9.

in the visual display groupings was assigned a "warning flag" for that variable. The bottom line of the table sums those warning flags for the eighteen "worst" tracts.

TABLE 2

POTENTIAL TROUBLE SPOTS BASED ON
SOCIOECONOMIC VARIABLES

	Census Tract Number																	
Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Population Density	X	X	X	X	X	X	X	X	.	.	X	.	.	X	.	.	.	X
Nonwhite Popn %	X	X	X	X	.	.	.	.	X	X	X	.	.	.	.	.	.	.
Median Fam. Income	X	X	X	X	.	.	.	X	X	X	X	.	X	X	.	.	.	.
Commercial Land Use %	X	.	.	.	.	.	X	.	.	.	.	X	X		X	X	X	.
Industrial Land Use %	.	X	.	X	.	.	.	.	X	X	.	X	.	.	X	X	.	.
WARNING FLAGS	4	4	3	4	1	1	2	2	3	3	3	2	2	2	2	2	1	1

Outside this core of eighteen census tracts from the inner city, only tract 21, the heavy industrial tract in the northwest, need be mentioned. The remaining tracts do not present the mix of socioeconomic characteristics that would cause us, on preliminary examination, to suspect a high crime rate.

The Crime Data

Local Data Source

The data provided by the Lexington-Fayette Urban County Division of Police were ideally suited to this type of analysis. For many reasons they were better than the

FBI data normally used in crime studies. The incidents were geo-coded to the census tract and block level, an absolute requirement for a location-specific study such as this. UCR data are reported only as totals for the reporting unit--usually the Standard Metropolitan Statistical Area (SMSA). The data base was an active one, so it had been purged of incorrect records that had been discovered subsequent to entry, or cleared of incidents that had been declared as unfounded. Foremost, however, was the fact that the data contained times of events and days of the week--data that are only maintained at the local level. In fact, the data record contains fields for every entry made on the paper report of the incident, from complainant name to solvability codes for evidence status.

The data file consists of 43,024 case records which are differentiated by unique case record numbers. In those instances where a case involved multiple offenses (e.g. rape and subsequent auto theft) unique case numbers are assigned with an alpha suffix. This sidesteps one of the underreporting criticisms of the UCR data. Eliminating from the data set those cases which had been cleared as unfounded, and selecting only those case records that pertained to index crimes or arson, resulted in a universe of 21,507 cases within the county.

The Time Period

The case records pertain to the period from October, 1983 to June, 1985. A new coding manual was initiated for the purpose of entering the data records in September of 1983, and personnel from the Planning and Analysis Section indicated that material prior to that date was suspect. In June of 1985 the data base was closed out as the Division of Police relocated to their current Main Street location and converted to a new computer system with its own, tailored data base. Consultants for the firm installing the new data base will eventually convert the old data, that were used in this study, to a format compatible with the new system.

It is recognized that using 1980 census data will introduce a time lag into the comparisons with what is essentially 1984-85 crime data, and recognition of this fact should be stated during discussion of results obtained--particularly in the peripheral census tracts where recent residential expansion has been most pronounced. Nevertheless, the data set is a good one, and provides ample records from which the analysis can be conducted.

Data Base Conversion

Because of the system changeover at the Division of Police, a data conversion problem existed. The case records had been stored on an IBM Series I minicomputer and

were written to eight-inch floppy diskettes to be saved as backup. In order to conduct statistical analysis at the University of Kentucky Computing Center (UKCC), the data had to be introduced into the main IBM computer. UKCC did not have an eight-inch diskette drive that could be used, so the data had to be converted in an intermediate step to a tape format.

Fortunately the Lexington-Fayette Urban County Division of Computer Services had the capability to dump the data to an IBM-compatible tape which could then be read into the UKCC mainframe computer. After a tape map was made of the data records on the tape, the tape was read in with the Statistical Package for the Social Sciences - Version X (SPSS-X), and a system file was created.[4]

The data stored on eight-inch diskettes was stored in date-record-year order--a format which makes it difficult to search for sequential data. Additionally, one diskette was inadvertently erased prior to conversion and, as a result, data from December of both years (1983 & 1984) were lost. As a consequence, seasonal comparisons, one of the original objectives of this study, could not be accomplished. Seasonality is the most studied periodic aspect of crime data, however, and the unique aspect of this study is in the daily and weekly rhythms uncovered in the data.

The Time Variables

The case records used in this study included several data fields relating to time. Most important among these were those labelled "Earliest Possible Time", "Latest Possible Time", "Earliest Possible Day", and "Latest Possible Day." For those crimes where there is generally a human victim and/or witnesses, such as assault, robbery, and rape, the "Earliest" and "Latest" data fields usually contain the same information. For residential burglary, larceny, and auto theft there is frequently a time gap between the two, and for nonresidential burglary the gap (over a weekend, perhaps) may be even larger.

The question arose very early on during the study concerning solution of this problem. Three choices seemed evident: use the earliest, use the latest, or pick a midpoint. The latter option was eliminated first. It seemed statistically faulty to pick a midpoint between, say, 4:30 PM closing time on Friday and 8:00 AM opening time on Monday morning. Additionally, discussions with detectives seemed to suggest that, at least in the case of burglary, those criminals who "case" a potential site would prefer to strike just after somebody leaves, rather than try to guess about when the proprietor might be about to return.

It was decided that using the "Earliest Possible Time" and "Earliest Possible Day" data fields would be the preferred method, and that subsequent discussions of

findings regarding those "indistinct" types of crime would carry a caveat.

Summary

Fayette County has been examined with respect to political organization and socioeconomic diversity. Based on a number of socioeconomic indicators, traditional correlates of crime in the urban environment, a set of census tracts has been identified which can be expected to experience high crime rates. The nature of the local crime data from which areal crime rates will be computed has also been examined, and the valuable addition of a time variable, not available at other than the local level, has been stressed.

Chapter V presents the major findings of the study via a series of maps and graphs that explore spatial and temporal distributions. It also discusses the explanatory value attributable to the time variable in the several regression equations.

CHAPTER V

FINDINGS

Validation of the Study Area

As indicated in Chapter III, the multiple regression was used to examine the ability of the independent variables to explain the variation in crime rates among census tracts.[5] In the initial regression run all seven of the variables associated with Hypotheses 1 - 7, were entered into each of two multiple regression equations. The first used as the dependent variable the rate of violent crime per 100,000; the second used the rate of property crime per square mile. It should be noted that these rates cover a period of approximately eighteen months, and thus they should not be compared with published annual rates unless a factor of .67 is applied.

Examination of the table of partial correlation coefficients (table 3) indicated only one pair with an unacceptable level of collinearity (-.739), that between X_7 - the distance variable, and X_1 - the population density variable. In analyses where factor analysis or principal components analysis will not be employed, it is customary to eliminate one or the other of such collinear variables.

In classic urban studies the gradient effect has been consistently upheld, yet the decision was made to eliminate X_7 (distance) from subsequent analyses for three reasons.

TABLE 3

CORRELATION MATRIX OF SOCIOECONOMIC VARIABLES

	Popden	Nonwh%	MedFam	Comm%	Indu%	HwyMi	CBDDist
Popden	---	.296	-.507	.305	.027	.448	-.739
Nonwh%	.296	---	-.560	-.012	.325	-.042	-.284
MedFam	-.507	-.560	---	-.275	-.423	-.314	.390
Comm%	.305	-.012	-.275	---	.229	.495	-.467
Indu%	.027	.325	-.423	.229	---	.250	-.319
HwyMi	.448	-.042	-.314	.495	.250	---	-.585
CBDDist	-.739	-.284	.390	-.467	-.319	-.585	---

First, distance also correlated higher with the other independent variables than did population density. Elimination of distance, therefore, should enable the regression equation to define a set of more significantly different (orthogonal) independent variables. Second, distance from the CBD seems to be a proxy variable that contains little causal meaning in itself. City structures are becoming more complex, and the existence of a beltway like New Circle Road and its allied shopping areas tends to create growth nodes away from the city center.

Perhaps the most compelling reason, however, is a clear focus on the theoretical objectives of the study. If one wishes to do something about crime in the urban environment one must focus on the variables that hold some promise for possible change--social engineering if you

will! City planners can create a mix of land uses or target populations for specific social programs, but they can do little to change distance.

Despite the fact that some of the original seven variables did not test out to be significant (T-test) at the .05 level, both equations tested as significant (Snedecor's F-test) to four decimal places. Tables 4 and 5 present the statistics for the variables in both equations.

TABLE 4

7 VARIABLE REGRESSION - VIOLENT CRIME

Variable	B	BETA	T-Test	Sig T
Popn Den	- .016	-.0306	- .216	.830
Nonwhite %	31.577	.4420	4.316	.000
Med Fam $	- .065	-.3197	-2.696	.010
Commer %	59.669	.3737	4.015	.000
Indust %	11.908	.1096	1.094	.280
Hiway miles	47.003	.0543	.516	.609
CBD Dist	1.093	.0018	.012	.990
(CONSTANT)	1628.191		1.503	.140

R^2 = .75641   Significance F = .0000

TABLE 5

7 VARIABLE REGRESSION - PROPERTY CRIME

Variable	B	BETA	T-Test	Sig T
Popn Den	.040	.2381	1.978	.055
Nonwhite %	2.143	.0929	1.065	.293
Med Fam $	-.012	-.1979	-1.960	.057
Commer %	31.361	.6082	7.674	.000
Indust %	-2.307	-.0657	-.771	.445
Hiway miles	38.345	.1371	1.531	.133
CBD Dist	-.388	-.0019	-.016	.988
(CONSTANT)	97.147		.326	.746

R^2 = .82349   Significance F = .0000

Initial evaluation of Hypotheses 1 - 7 is based on the direction of the relationship expressed in the regression coefficients (B) and their significance based on the T-Test.

H_1: Serious crime rates are positively related to X_1 - residential population density. In the case of violent crime population density demonstrated a very low inverse relationship, but tested extremely insignificant with the T-test. Theory would tell us that nonresidential population density would be a better predictor of interaction and violent crime. In the case of property crime population density did demonstrate the expected direction in the relationship and tested significant at the .055 level. H_1 is not rejected as relates to property crime.

H_2: Serious crime rates are positively related to X_2 - nonwhite percent of population. The expected direction of the relationship held for both types of crime, but the relationship was significant at the .05 level only for violent crime. H_2 is not rejected as relates to violent crime.

H_3: Serious crime rates are negatively related to X_3 - median family income. The expected direction of the relationship held for both types of crime, and tested as significant (.010 and .057) on the T-Test. H_3 is not rejected for either violent crime or property crime.

H_4: Property crime rates are positively related to X_4 - percent of land used for commercial purposes. The expected direction of the relationship held for both types of crime, not just property crime, and tested significant to three decimal places in both instances. H_4 is not rejected for either violent crime or property crime.

H_5: Serious crime rates are positively related to X_5 - percent of land used for industrial purposes. While the expected direction of the relationship held for both types of crime, neither tested significant at the .05 level with the T-Test. H_5 is rejected.

H_6: Serious crime rates are positively related to X_6 - the density of principal commercial thoroughfares within the census tract. The expected direction of the relationship held for both types of crime, but neither tested as significant at even the .10 level with the T-Test. H_6 is rejected.

H_7: Serious crime rates are negatively related to X_7 - distance to the CBD. The expected direction of the relationship held for property crime, did not hold for violent crime, and tested very insignificantly on the T-Test. Given the already identified collinearity problem with this variable, H_7 is withdrawn from further consideration.

Having narrowed the number of variables of interest, another series of regression runs was performed. The results of these runs are presented in tables 6 and 7.

TABLE 6

3 VARIABLE REGRESSION - VIOLENT CRIME

Variable	B	BETA	T-Test	Sig T
Nonwhite %	31.847	.4458	4.828	.000
Commer %	64.757	.4056	5.098	.000
Med Fam $	-.072	-.3559	-3.707	.000
(CONSTANT)	1879.142		3.708	.000

The equation returned an R^2 value .743 and tested significant (F-Test) at .0000. An examination of the BETA weights (standardized coefficients) leads us to conclude that the independent variables are listed correctly in their order of importance to the equation, that is: non-white percent of population is the most significant factor, followed by commercial land use and median family income.

TABLE 7

3 VARIABLE REGRESSION - PROPERTY CRIME

Variable	B	BETA	T-Test	Sig T
Commer %	32.633	.6328	9.280	.000
Popn Den	.051	.3055	4.015	.000
Med Fam $	-.015	-.2249	-2.983	.005
(CONSTANT)	187.750		1.340	.187

The equation returned an R^2 value of .810 and tested significant (F-Test) at .0000. Examination of the BETA weights tells us that commercial land use is the most reliable predictor, followed by population density and median family income. The fact that the constant term did not test significantly tells us that possibly other, unspecified variables play a role in this equation.

Based on the direction of the relationships examined, the validity of a number of the hypotheses, and the strength of the final two regression equations, the reasonableness of Lexington as a study area is supported. Lexington's crime distribution pattern is influenced most by the same socioeconomic factors that were identified in larger cities like Chicago (Shaw and McKay 1942), Cleveland (Corsi and Harvey 1975), Denver (Lee and Egan 1972), and Atlanta (Munford et al. 1976), to name only a few. It appears that further investigation of time factors in explaining the distribution of crime in Fayette county could yield results applicable to other medium-sized and larger cities.

Spatial Distributions by Crime Type

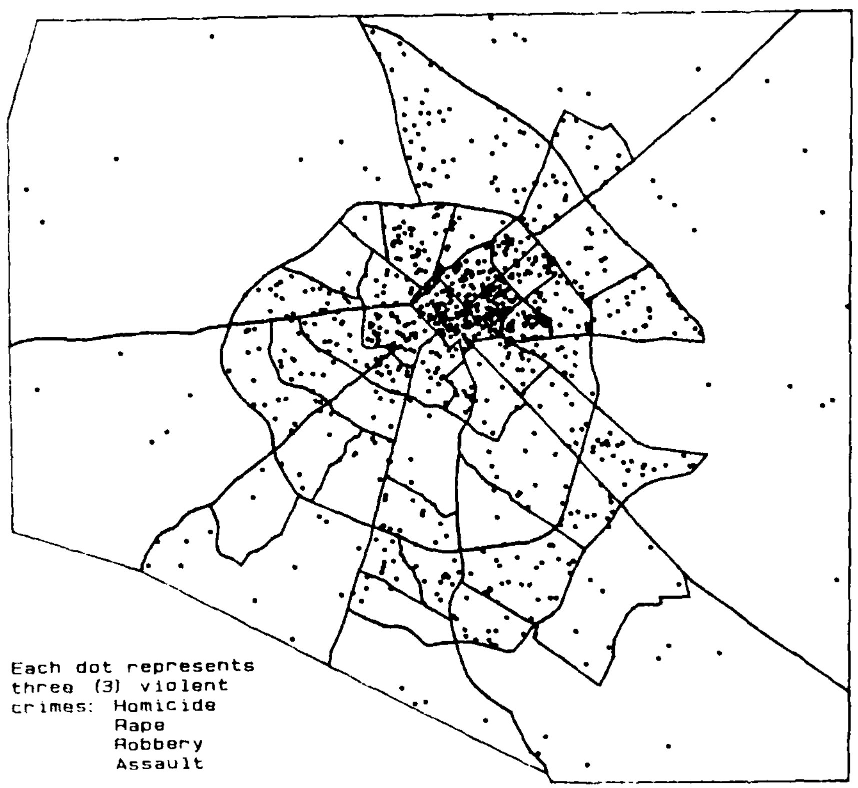
Violent Crime

Map 10 is a dot representation of the incidence of violent crime (homicide, rape, robbery, and assault) in the county. The locations are not exact, but the distribution pattern is accurate with respect to numbers of incidents within a census tract. Each dot represents three such crimes that occurred during the period October, 1983 to June, 1985.

The area near the Central Business District, comprised of the now familiar census tracts 01 - 04, appears vividly on this map. This area had been identified as a potential trouble spot in Chapter IV when examining

VIOLENT CRIMES (CRIMES AGAINST PERSONS)

Fayette County, Kentucky Oct 83 - Jun 85



Map 10.

"warning flags" concerning high population density, high nonwhite percent of population, low median family income, and a high percent of land used for commercial purposes.

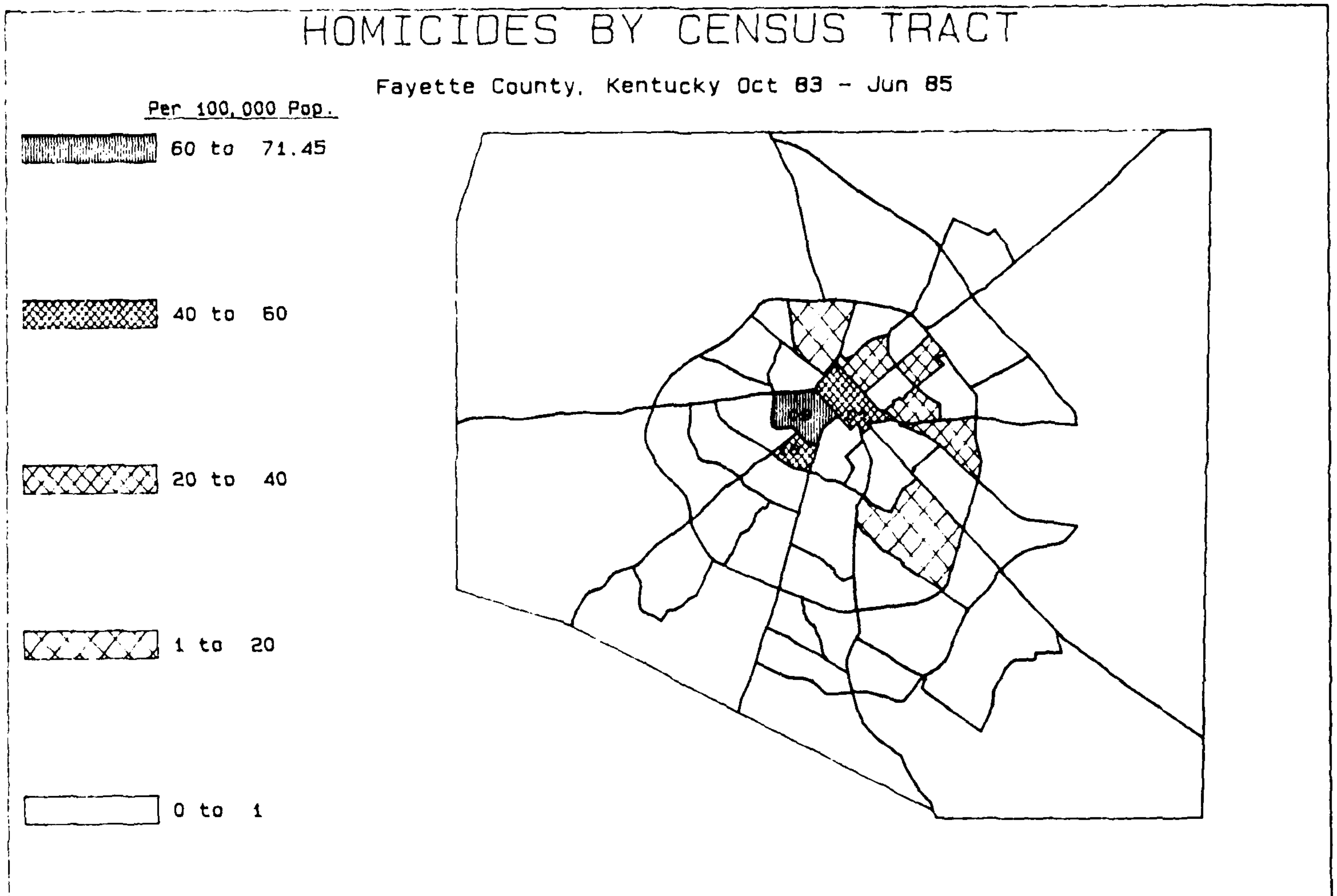
The series of maps that follows was generated using the same criteria as the series of maps on socioeconomic data. Again, the Kruskal-Wallis test was used as a calibrating device to generate five groups whose means differ significantly from one another, (at the .05 significance level) but whose membership approximates the 5,8,26,8,5 distribution for display purposes. Table 8 summarizes the results of those groupings.

TABLE 8

CENSUS TRACT COUNTS BY MAP GROUPINGS
VIOLENT CRIME RATES

Crime Rate	No Data	Zero Cell	Group Number 1	2	3	4	5	6*
Homicide	0	43	0	2	4	2	1	-
Rape	0	0	4	9	26	8	5	-
Robbery	0	0	4	9	25	9	5	-
Assault	0	0	4	9	26	7	6	-
Violent	0	0	5	8	26	8	5	-

Map 11 shows the distribution of homicides within the county. Even with a small base (only eleven cases in the data set), several observations are appropriate. The highest rates pertain to the central-city tracts 01, 09 and 18, all of which are characterized by high density, low income,


HOMICIDES BY CENSUS TRACT
Fayette County, Kentucky Oct 83 - Jun 85
Per 100,000 Pop.
60 to 71.45
40 to 60
20 to 40
1 to 20
0 to 1

Map 11.

industrial/commercial land use, or some mix of these characteristics. The remaining tracts in which homicides were registered are all within New Circle Road, and are concentrated in the near north-side area. Although eleven incidents is a small number on which to base generalizations, the discussion of other violent crimes below supports this same pattern of inner-city violence.

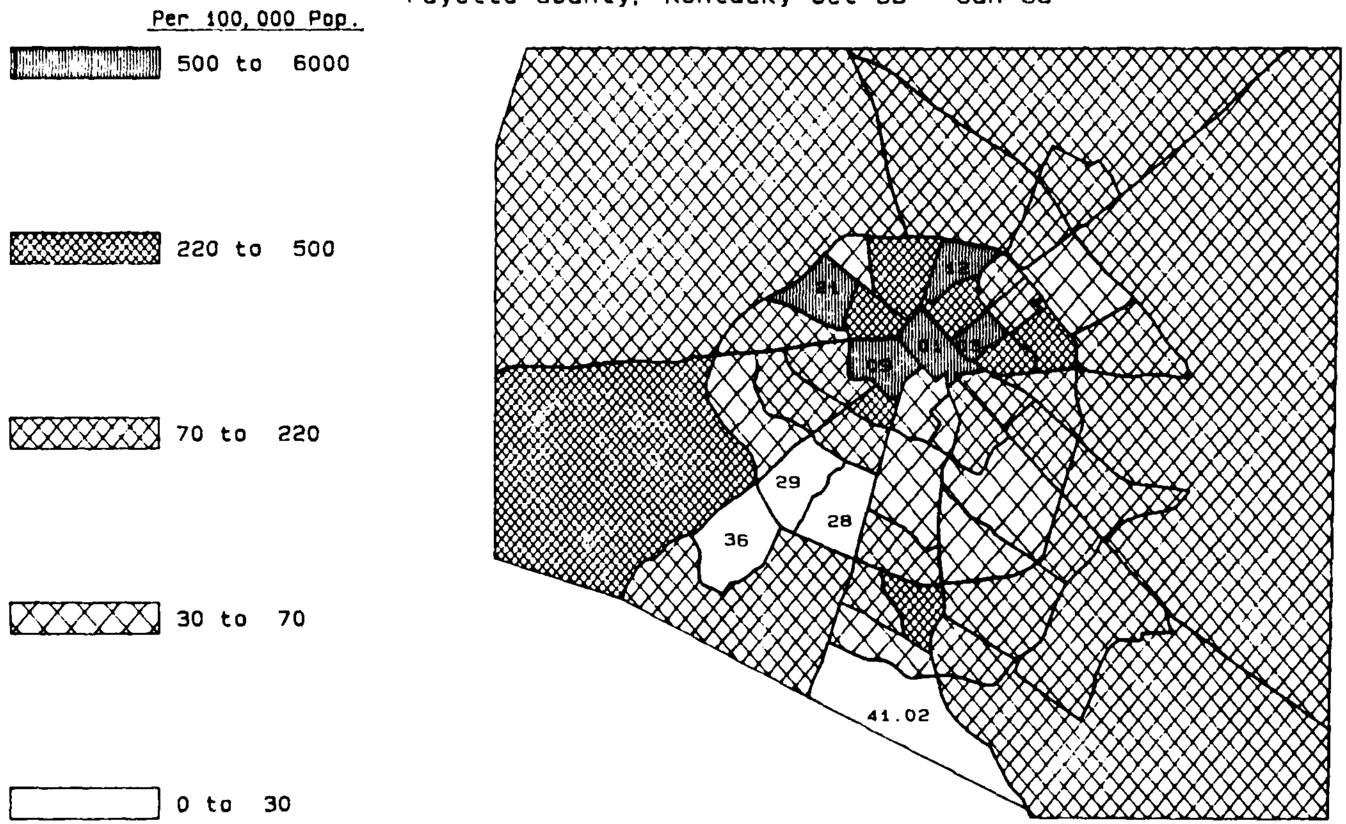
The distribution of rape (map 12) within the county resembles that for homicide, with most of the group 4 and 5 tracts contiguous with the CBD. Exceptions to this are found in the Belleau Wood area (tract 35.02, south of New Circle) which is more than 87 percent residential (high-density apartments), and the Harrods Hill and environs (tract 42.02, southwest corner outside New Circle) which contains both high-density apartments and the airport.

Robberies (map 13) are even more concentrated in the extreme (group 5) tracts, aligning with North Broadway, and reflecting a mix of high population density, low income, and high commercial land use.

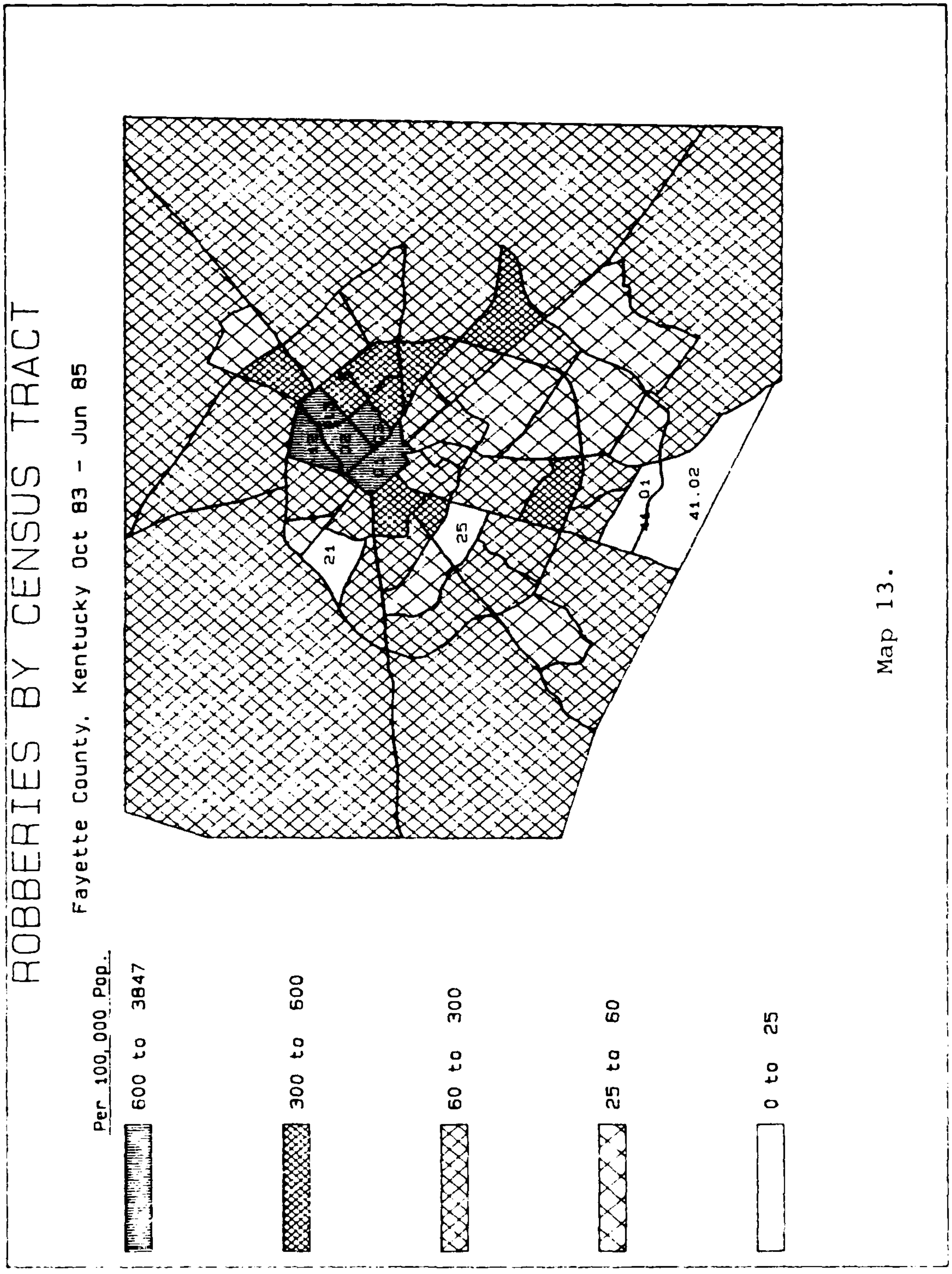
The distribution of assaults (map 14) is virtually identical to that for homicides, particularly in the extreme (group 4 and 5) areas. One notable addition is tract 38.01 (north, outside of New Circle), a suburban expansion zone which is 66.7 percent nonwhite but in group 3 (the large, median category) with respect to median family income.

RAPES BY CENSUS TRACT

Fayette County, Kentucky Oct 83 - Jun 85



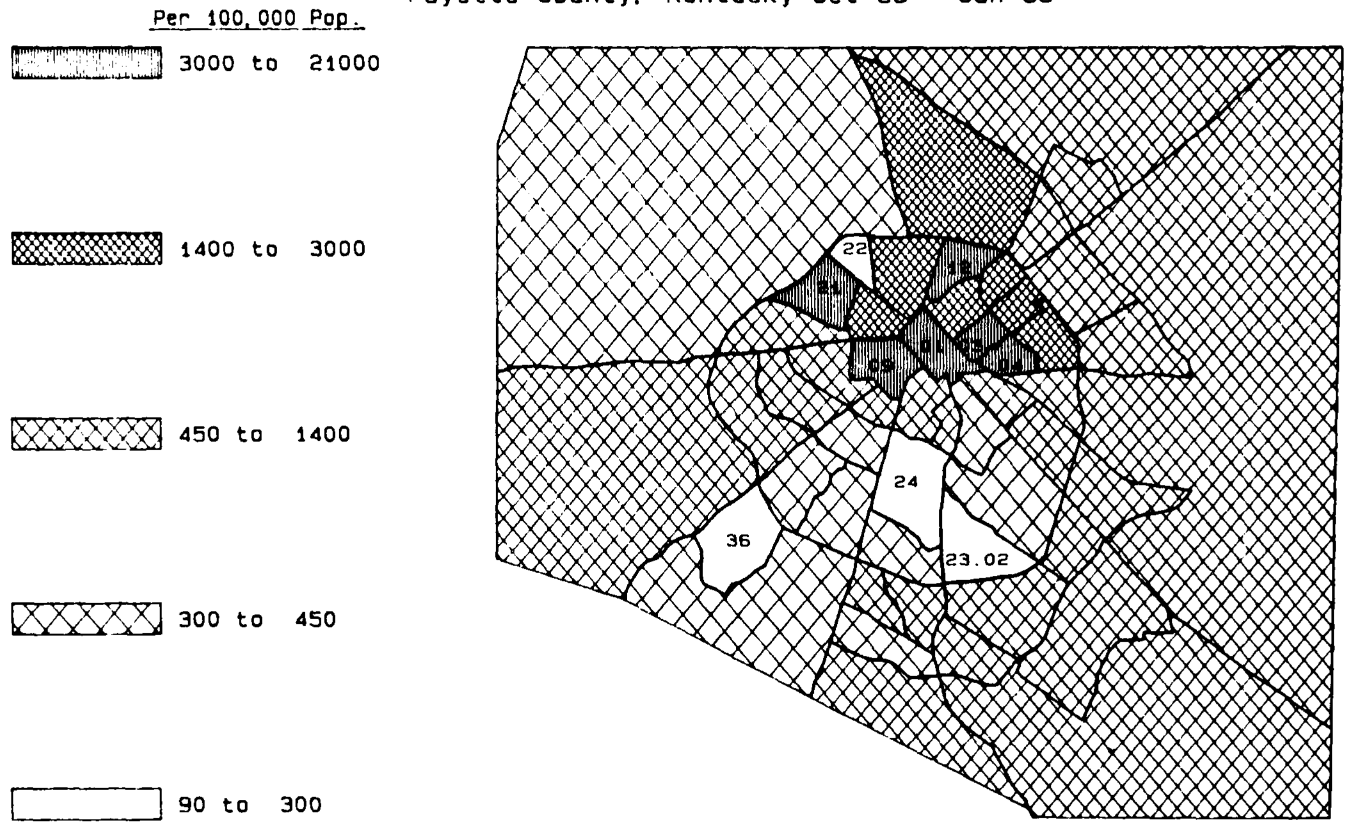
Map 12.


ROBBERIES BY CENSUS TRACT
Fayette County, Kentucky Oct 83 - Jun 85
Per 100,000 Pop.
600 to 3847
300 to 600
60 to 300
25 to 60
0 to 25
21
25
41.02

Map 13.

ASSAULTS BY CENSUS TRACT

Fayette County, Kentucky Oct 83 - Jun 85



Map 14.

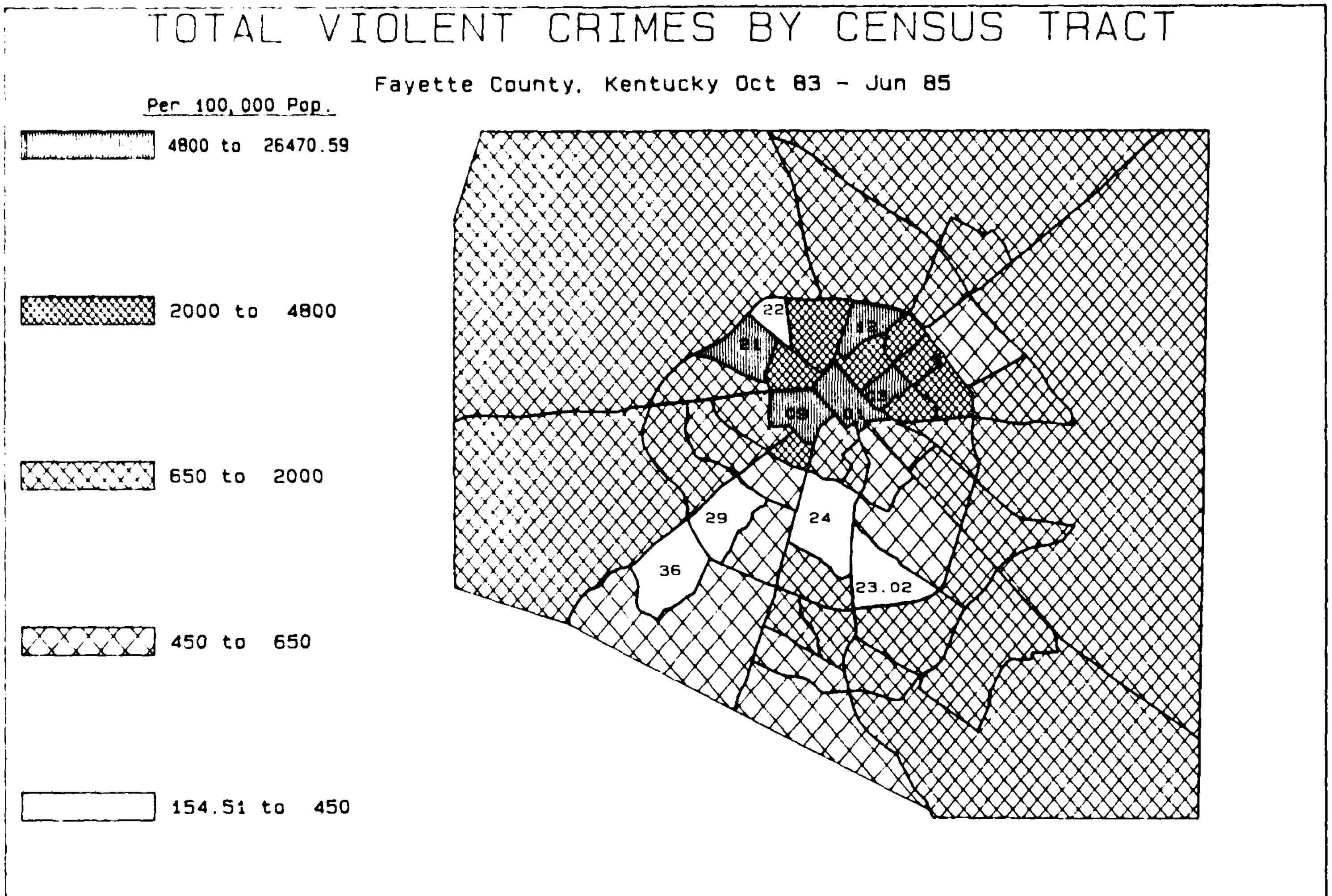
Map 15 summarizes the distribution of all violent crimes in the county and displays it in terms of a single rate per 100,000 resident population. It focuses attention on the plight of the north side inside of New Circle Road, and explains the premium paid for lots and housing on the south side.

Property Crime

Map 16 is a dot representation of the incidence of property crime (burglary, larceny, and auto theft) in the county generalized by census tract. Each dot represents ten such crimes. The Central Business District (tract 01), is easily identified on the map, however the clustering that was seen in the adjacent areas on the violent crime map seems to have dispersed somewhat.

The next series of maps was generated using the same criteria as the series of maps on violent crime. Table 9 summarizes the results of grouping census tracts based on property crime rates using the Kruskal-Wallis test as a calibrating device.

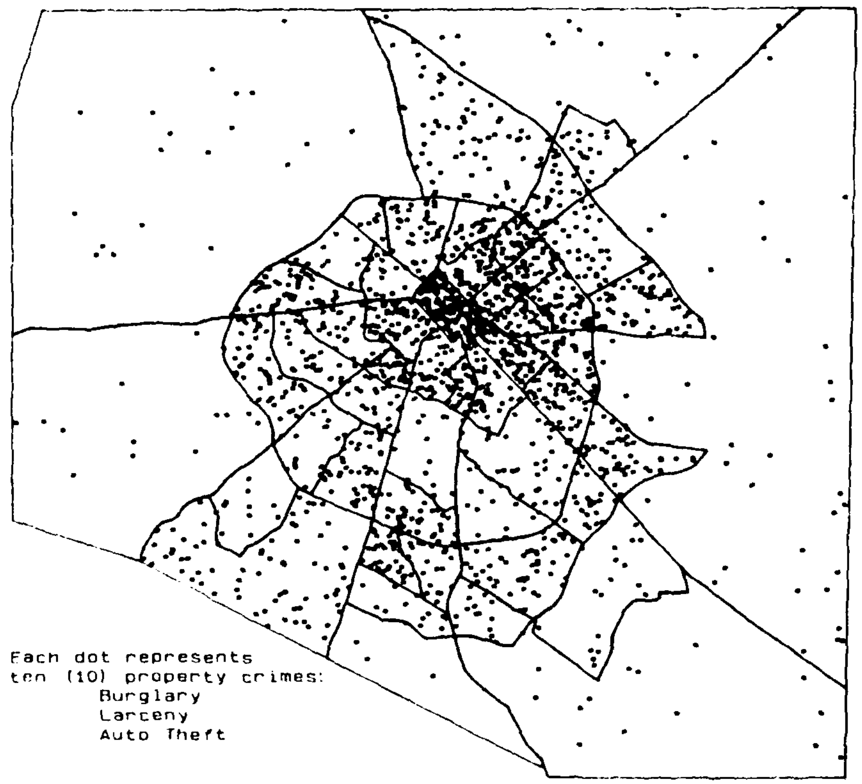
The role that large shopping malls play in shaping the distribution of crime in the region is evident when larcenies, the most numerous crime in the data base, are examined. This explains why the police have chosen to locate their substations in or near such areas to provide rapid response and no doubt save on the expenditures for gasoline to "book" countless shoplifters.


TOTAL VIOLENT CRIMES BY CENSUS TRACT
Fayette County, Kentucky Oct 83 - Jun 85
Per 100,000 Pop.
4800 to 26470.59
2000 to 4800
650 to 2000
450 to 650
154.51 to 450
22
29
36
24
23.02

Map 15.

ALL CRIMES AGAINST PROPERTY

Fayette County, Kentucky Oct 83 - Jun 85



Each dot represents
ten (10) property crimes:
Burglary
Larceny
Auto Theft

Map 16.

TABLE 9

CENSUS TRACT COUNTS BY MAP GROUPINGS
PROPERTY CRIME RATES

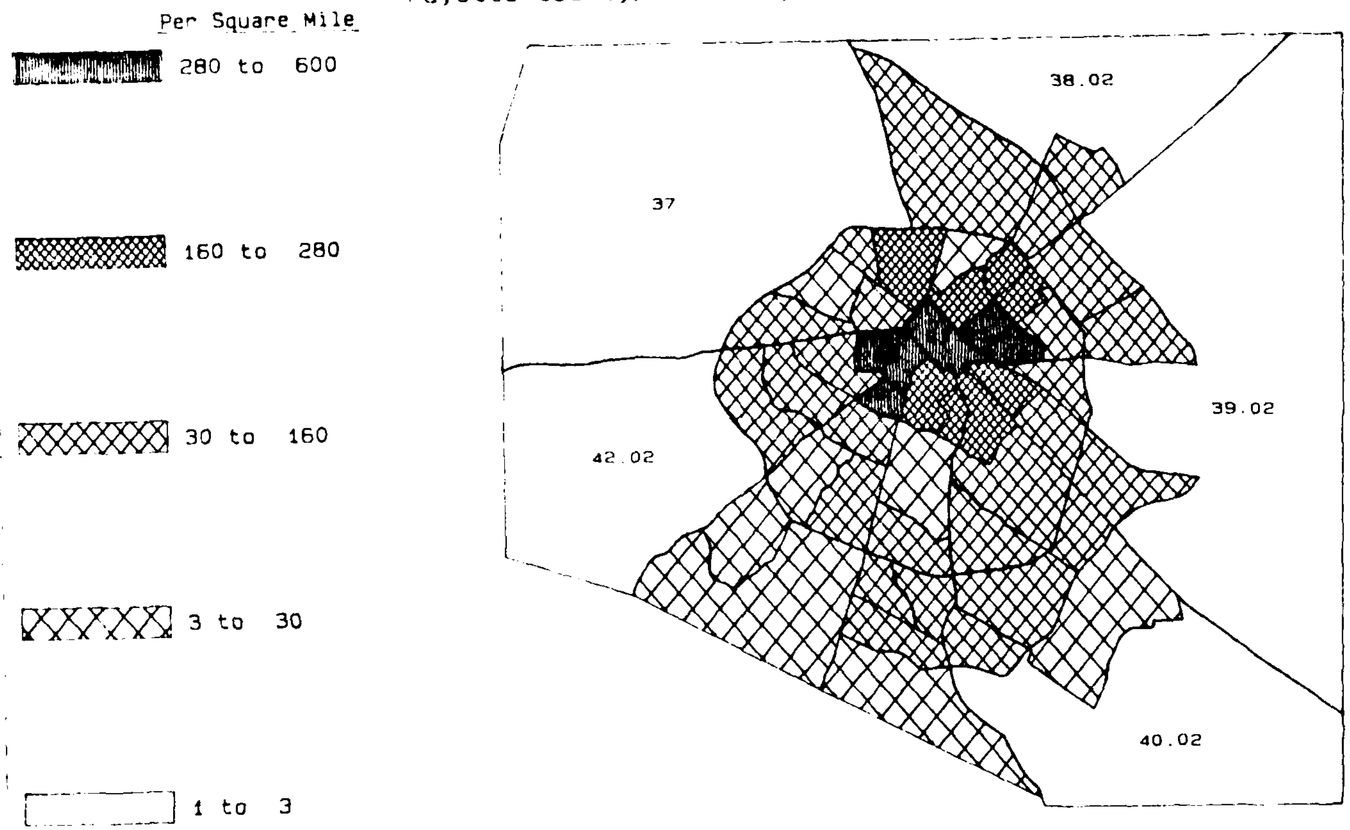
Crime Rate	No Data	Zero Cell	Group Number 1	2	3	4	5	6*
Burglary	0	0	5	8	26	8	5	-
Larceny	0	0	5	9	24	10	3	1
Auto Theft	0	0	5	9	26	8	4	-
Property	0	0	6	9	24	8	5	-

Map 17 shows the distribution of burglaries within the county. Again, the inner city plight is highlighted as all thirteen group 4 and 5 tracts are contiguous with the CBD, lie inside of New Circle Road, and show a northside bias. A majority of the median category tracts in the Lakeshore, Lakewood, and Lansdowne tracts are there (and not in a lower rate group) because of residential burglary, whereas the CBD and immediate environs are the site for both residential and nonresidential burglaries in abundance.

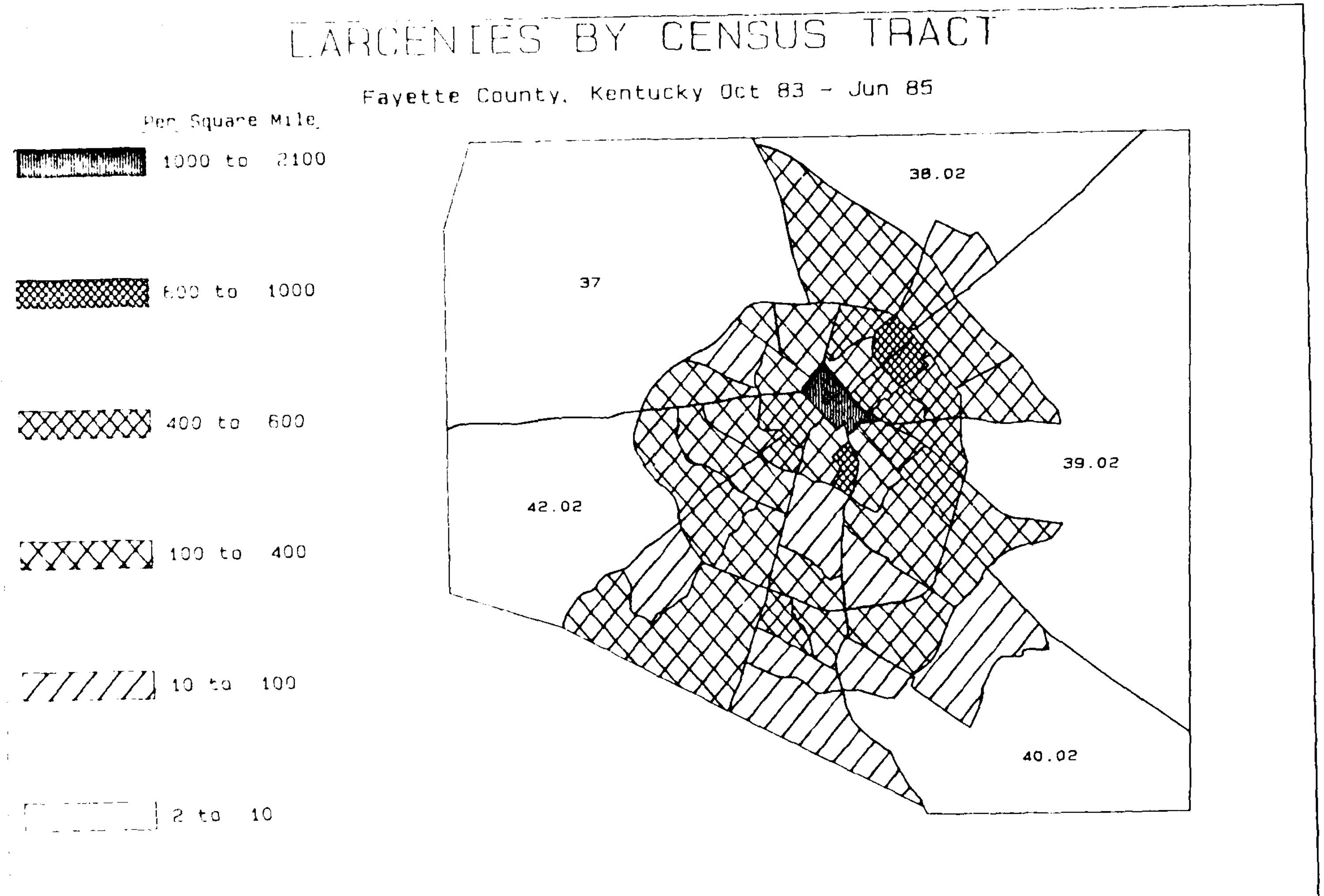
The distribution of larcenies presents a slightly shifted pattern (map 18). The CBD (tract 01) is in a class by itself, but the group 5 tracts are now in the Northland area (tracts 13 and 14), and tract 07 (Chevy Chase). It bears mentioning that these rates are calculated on a per-square-mile basis, and tracts 07, 13 and 14 combine small size with moderate commercial land use, thus concentrating opportunity for larceny. The group 4 tracts tend to favor

BURGLARIES BY CENSUS TRACT

Fayette County, Kentucky Oct 83 - Jun 85



Map 17.


LARCENIES BY CENSUS TRACT
Fayette County, Kentucky Oct 83 - Jun 85
Per Square Mile
1000 to 2100
600 to 1000
400 to 600
100 to 400
10 to 100
2 to 10
38.02
37
39.02
42.02
40.02

Map 18.

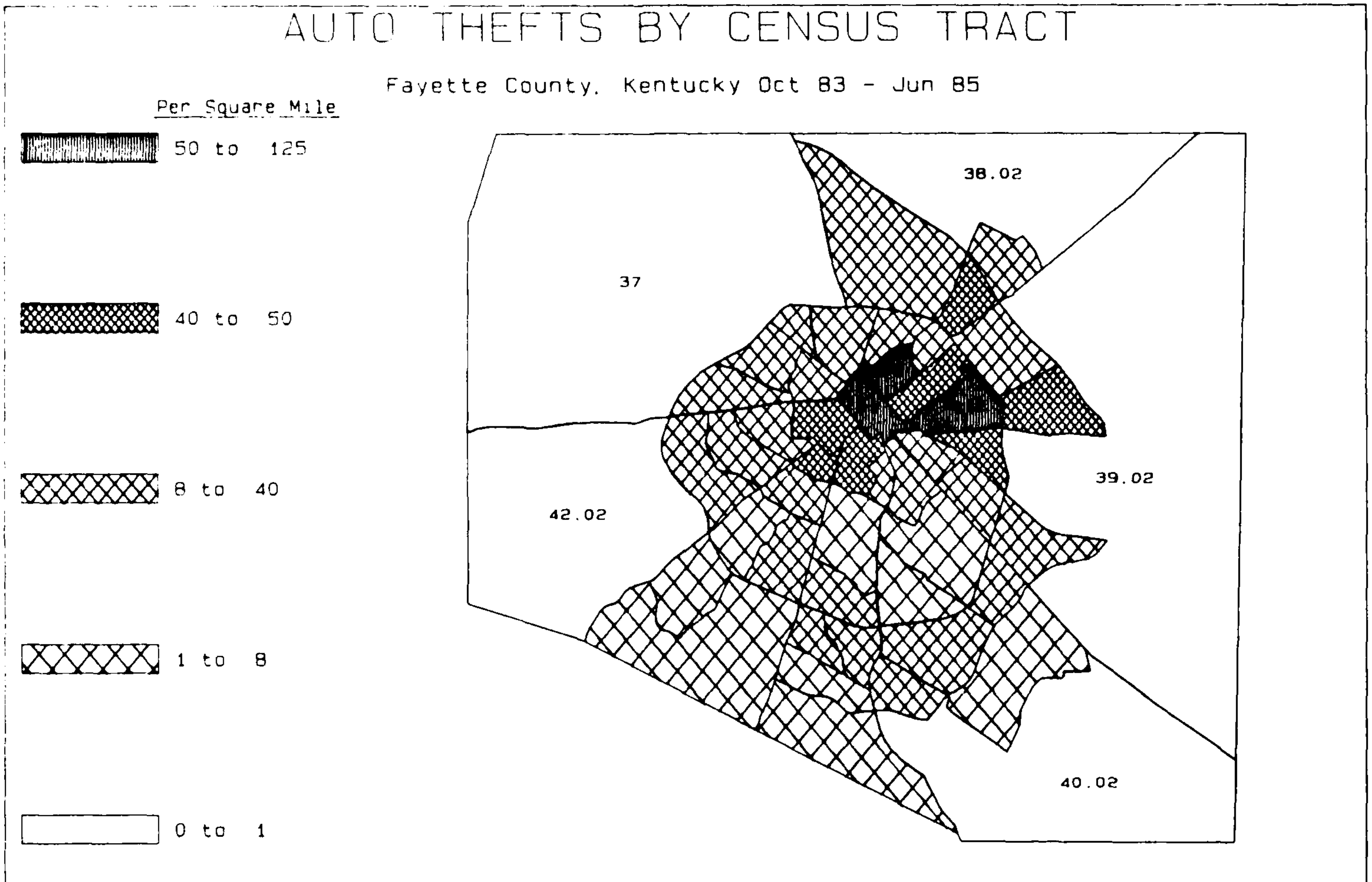
the northeast sector and tracts 09 and 18 along the downtown section of South Broadway.

The map for auto theft (map 19) displays a little more dispersion than most of the other crimes, and probably reflects a taste for better cars among the auto thieves. Although the north-central area is still highlighted, many of the autos stolen are from transients seeking entertainment rather than from residents. We find some new tracts represented in groups 4 and 5, including tract 08 (the University of Kentucky area), and several tracts along the northeastern segment of New Circle Road where a number of automobile dealers and shopping centers are located.

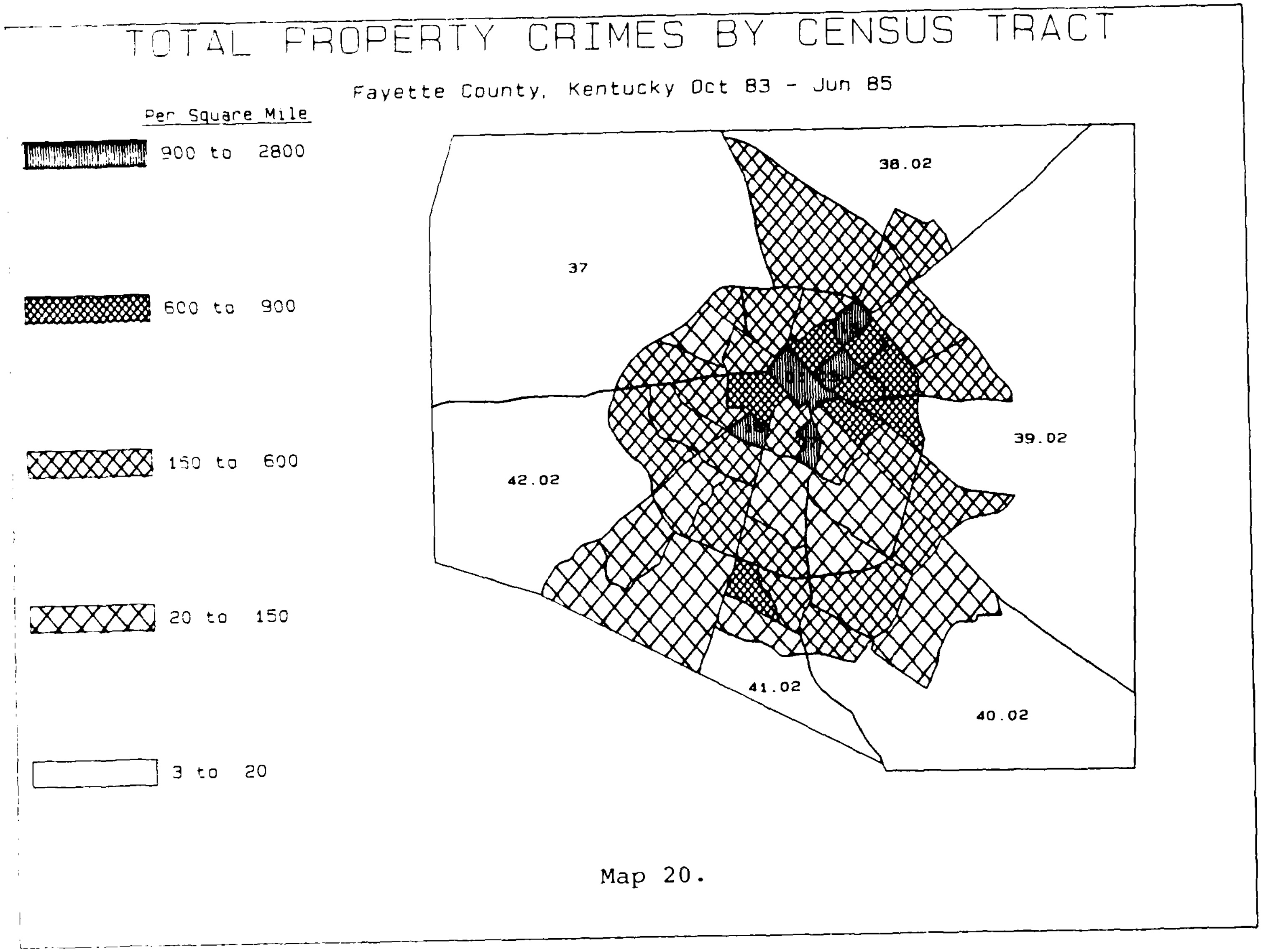
The summary map for property crime (map 20) reflects a subtle shift to the east when compared with that for violent crime. Gone is the high industrial land use tract (21), and in its place is a series of high commercial land use tracts adjacent to New Circle Road. The middle- and high-income, predominantly white neighborhoods of the south-central area do not escape the spread of property crime, and the lowest rates have shifted to the peripheral tracts. Again, part of this change is likely due to the rate computation differences between property crime and violent crime.

Arson

Arson can be either a property crime or a violent crime, depending upon the intent of the perpetrator. In


AUTO THEFTS BY CENSUS TRACT
Fayette County, Kentucky Oct 83 - Jun 85
Per Square Mile
50 to 125
40 to 50
8 to 40
1 to 8
0 to 1
37
38.02
39.02
40.02
42.02

Map 19.


TOTAL PROPERTY CRIMES BY CENSUS TRACT
Fayette County, Kentucky Oct 83 - Jun 85
Per Square Mile
900 to 2800
600 to 900
150 to 600
20 to 150
3 to 20
38.02
37
39.02
42.02
41.02
40.02

Map 20.

many cases arson is a crime done for hire, and in a city the size of Lexington it is conceivable that some 80 percent of the 120 arson cases in the data set could be attributed to a handful of "specialists." On the other hand, arson can also be a deadly weapon of revenge, and classification between the two types is often difficult.

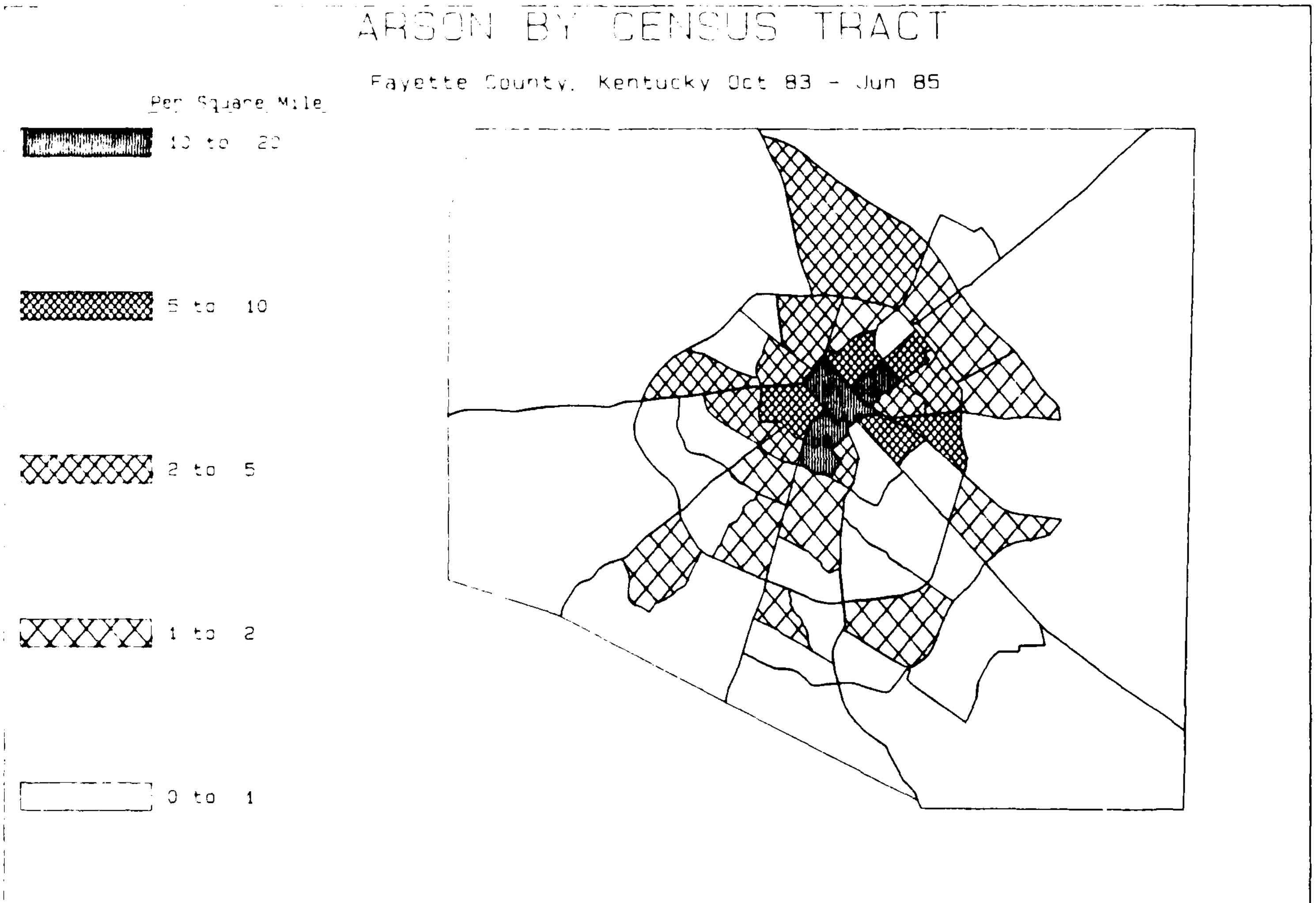
The distribution of arson incidents shown on map 21 appears to follow the established pattern of most crime in the city, favoring the CBD and environs, with a skew toward the near north side. The numbers of events, as was the case with homicide, really do not support far reaching conclusions regarding the difference in rates by census tract.

Temporal Distributions by Crime Type

The Daily Cycle

Time graphs were prepared for each crime type and for the two subdivisions (property crime and violent crime) indicating the percent of occurrences at each hour of the day. In deference to the planning needs of law enforcement agencies, an effort was made to identify six four-hour time "slices" that represented significantly different rates for each of the crime types and for the aggregations.

A simple discriminant function was used which resulted in six such time blocks starting with the period 07:00 to 11:00 AM. These blocks were tested using the Kruskal-Wallis test and were found to represent the most


ARSON BY CENSUS TRACT
Fayette County, Kentucky Oct 83 - Jun 85
Per Square Mile
10 to 20
5 to 10
2 to 5
1 to 2
0 to 1

Map 21.

significantly different means (at the .01 level) possible given the requirement to build four-hour blocks. The level of significance held for each of the crime rates and the two aggregate rates with the singular exception of homicide. Results of the Kruskal-Wallis test are given in Appendix C.

Figure 1 measures the percent of occurrences for each type of violent crime by time block. The four rates are remarkably similar, with the nearly stable daytime robbery rate and the slightly lower early evening rape rate constituting the only significant deviations from the general trends. Since these are crimes for which the actual time of occurrence is generally known with some degree of certainty, the graph and the accompanying Kruskal-Wallis significance test lead us to suspect that inclusion of the time variable should add greatly to our ability to predict criminal events in space.

Figure 2 compares the time curves for larceny and auto theft. Both appear to rise earlier in the day than did the violent crime curves, but they drop off at about the same rate. Given the frequent uncertainty of the exact time when an automobile was stolen, it seems reasonable to assume that, in actuality, the curve is flatter and shifted to the right.

Figure 3 compares residential and nonresidential burglaries, two crimes that might well be committed by the

Fig. 1.

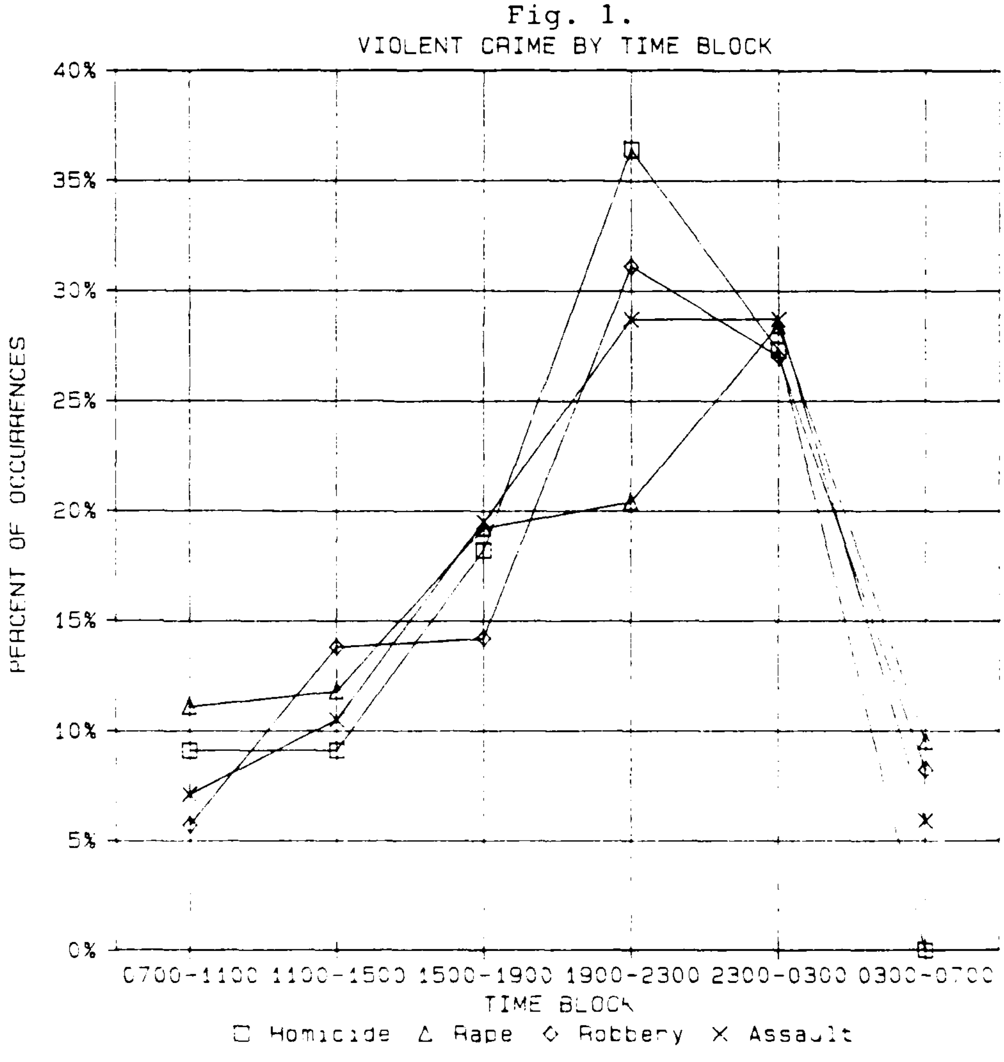

VIOLENT CRIME BY TIME BLOCK
40%
35%
30%
25%
20%
15%
10%
5%
0%
PERCENT OF OCCURRENCES
0700-1100 1100-1500 1500-1900 1900-2300 2300-0300 0300-0700
TIME BLOCK
Homicide Rape Robbery Assault

Fig. 2.

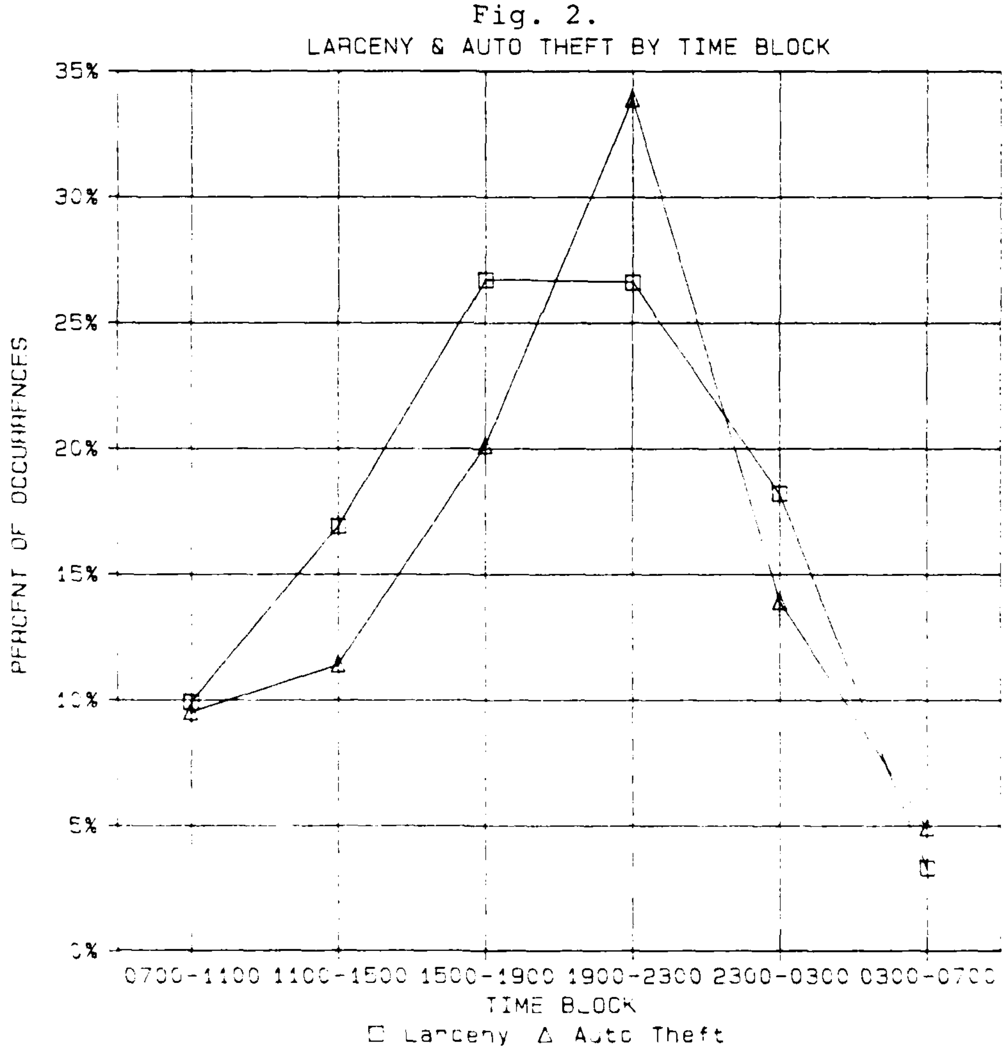
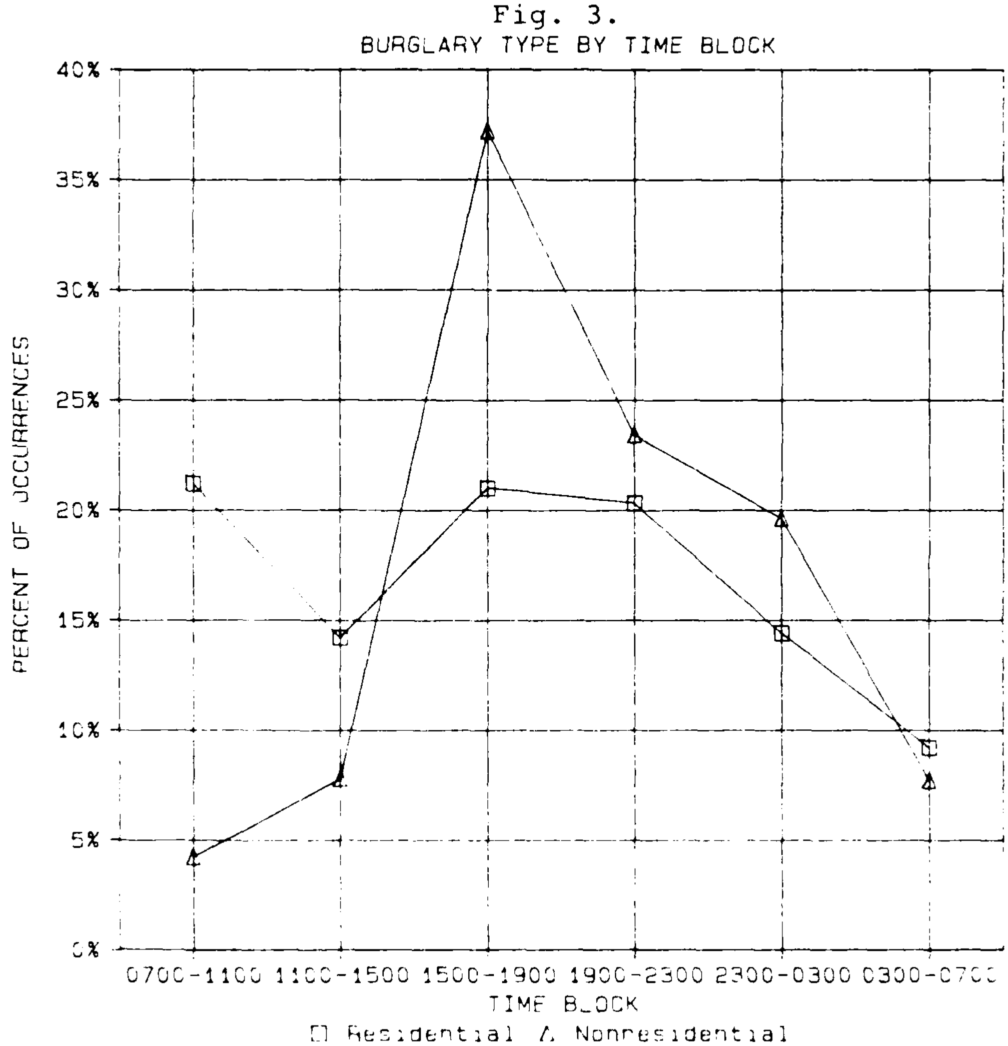

LARCENY & AUTO THEFT BY TIME BLOCK
35%
30%
25%
20%
15%
10%
5%
0%
PERCENT OF OCCURRENCES
0700-1100 1100-1500 1500-1900 1900-2300 2300-0300 0300-0700
TIME BLOCK
Larceny
Auto Theft

Fig. 3.


BURGLARY TYPE BY TIME BLOCK
40%
35%
30%
25%
20%
15%
10%
5%
0%
PERCENT OF OCCURRENCES
0700-1100 1100-1500 1500-1900 1900-2300 2300-0300 0300-0700
TIME BLOCK
□ Residential △ Nonresidential

same people, but quite different in terms of their time regime. Residential burglaries coincide with unguarded times, and avoid the lunch hour when the keeper of the house might have returned between shopping trips or before running to pick up the youngest at the school.

Nonresidential burglaries avoid the 07:00 to 11:00 time block and peak in the early evening. Again, this is one of those crimes where discovery may come much later, and we would expect that this curve would also flatten out and shift to the right if all the facts were known.

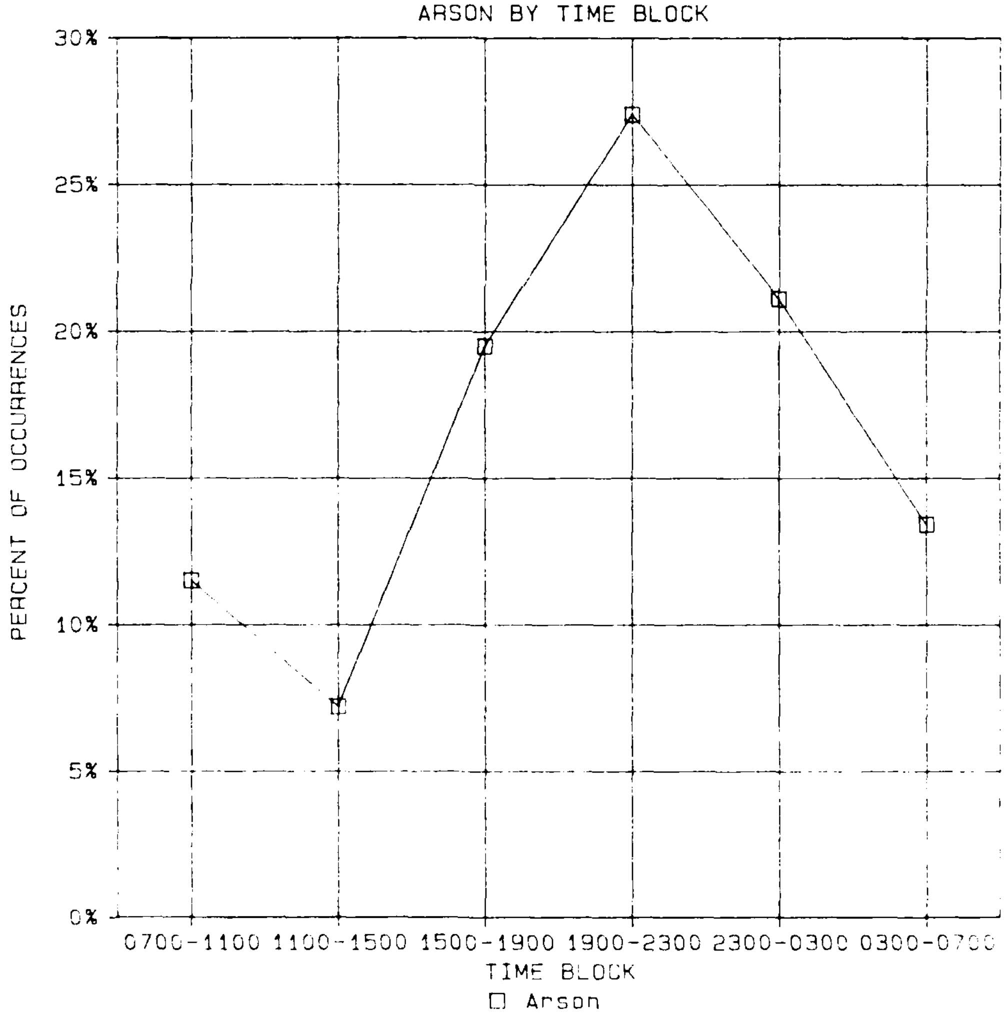
Arson (figure 4) is an evening crime where the cover of darkness can hide the criminal. The actual times are more fixed here than were those for auto theft and nonresidential burglary. The peak in the 19:00 to 23:00 time frame is probably accurate, however the median time of occurrence was 22:51 reflecting a bias toward the later nighttime period.

The Weekly Cycle

Days of the week did not turn out to be as powerful a classification device for crime rates as did the time slices. While the figures that follow seem to suggest that there is a difference in the daily rates, testing all seven day groupings with Kruskal-Wallis yielded insignificant results. In some cases the days could be grouped together in some fashion to achieve mean rates that were significantly different at the .05 level, but then only for a few

Fig. 4.

ARSON BY TIME BLOCK



crime types. As an example, Homicides had to be grouped into two classes: Friday vs. all other days before the .05 threshold of significance was passed. Results of the Kruskal-Wallis test are in Appendix D.

Nevertheless figures 5 through 8 on the following pages suggested the ultimate classifications for the Kruskal-Wallis test, and were used as the basis for structuring the space-day unit regression analyses discussed in the next section. With the exception of a Tuesday peak (and Wednesday for rape) in violent crimes, and a Wednesday /Sunday proclivity for arsonists, the rest of the graphs seem to suggest crime as a weekend activity for which one rests up on Thursday and from which one recovers on Sunday.

Such perturbations should not be dismissed lightly, however, and the earlier discussion about a possibly limited number of arsonists in the Fayette County area could lend enhanced significance to the Wednesday/Sunday peaks. If, in fact, there is a limited number of such "specialists" in the region, this graph might provide a clue as to their lifestyle and habits. It is precisely this type of underlying trend in the data that justifies the use of automatic data processing equipment by law enforcement agencies.

The Utility of Space Time Units in Analysis

The ultimate measure of the utility of adding time to the investigation of the spatial distribution of crime lies

Fig. 5.
HOMICIDE BY DAY OF THE WEEK

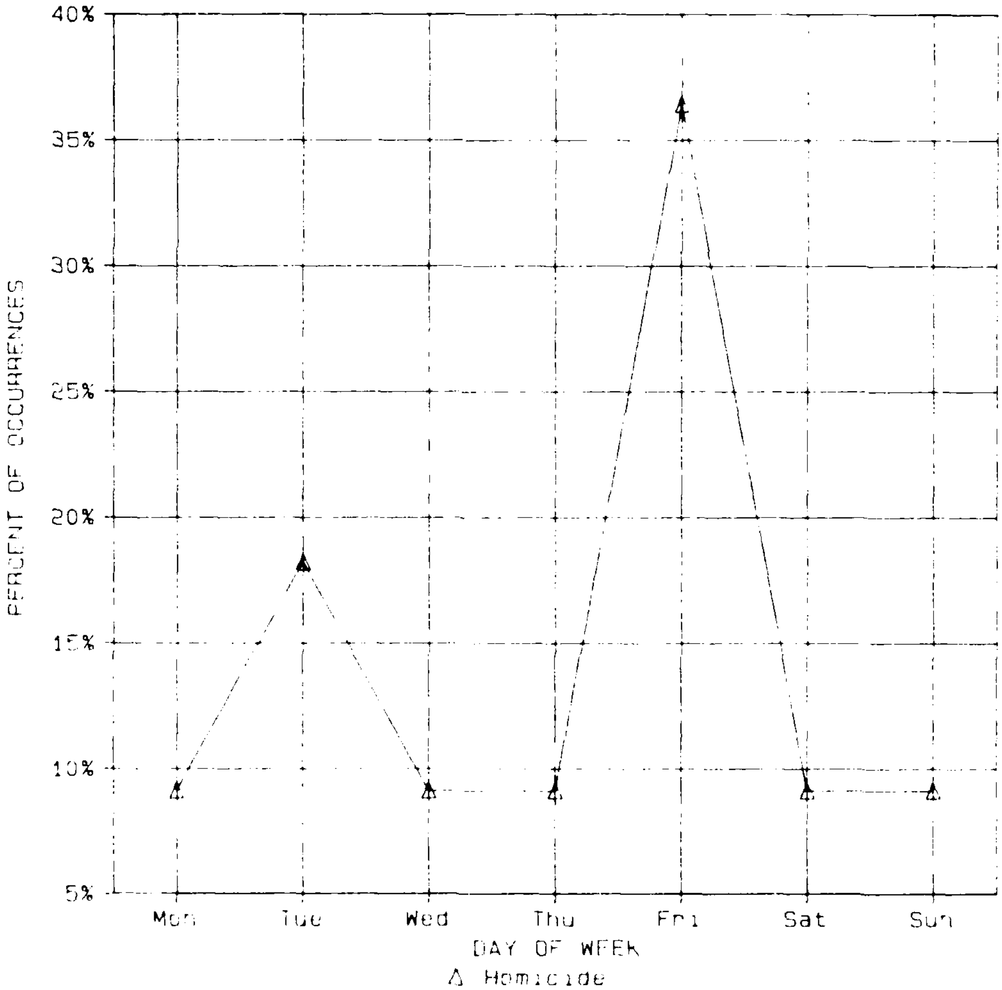


Fig. 6.

VIOLENT CRIMES BY DAY OF THE WEEK

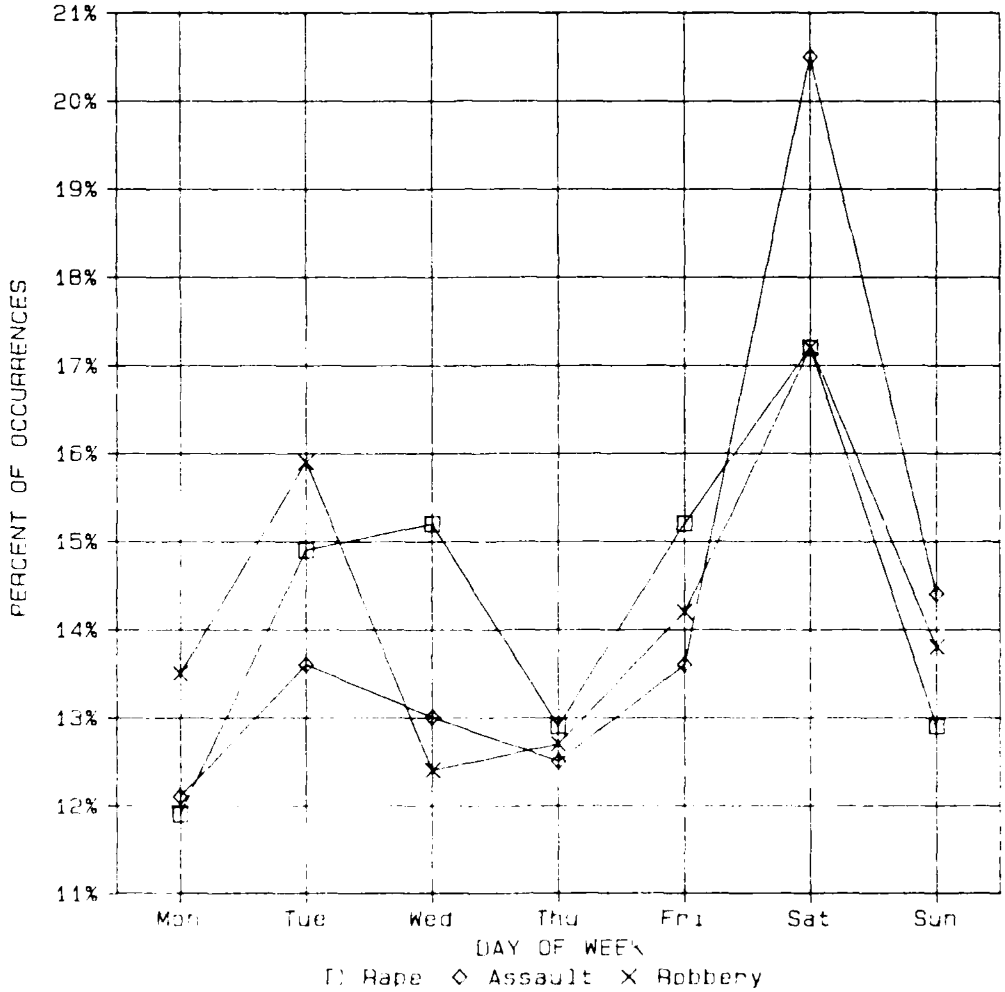
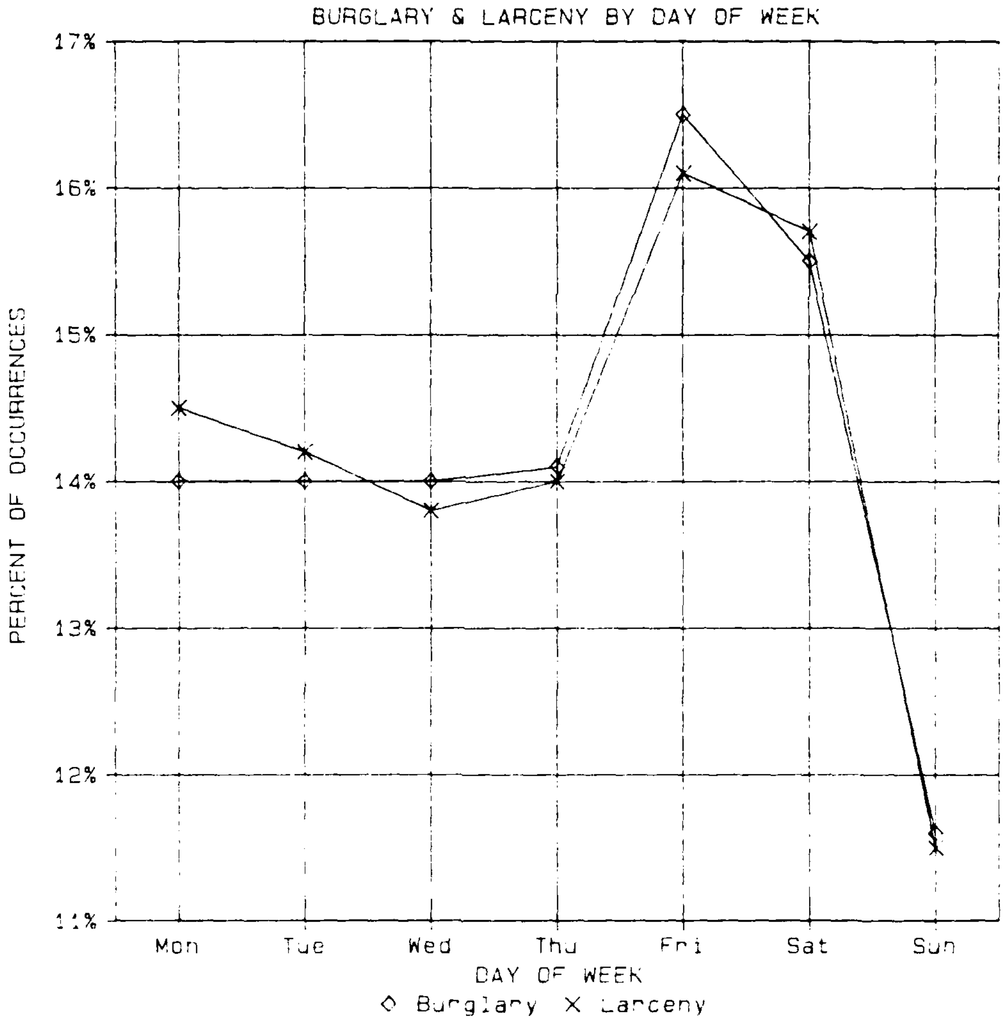
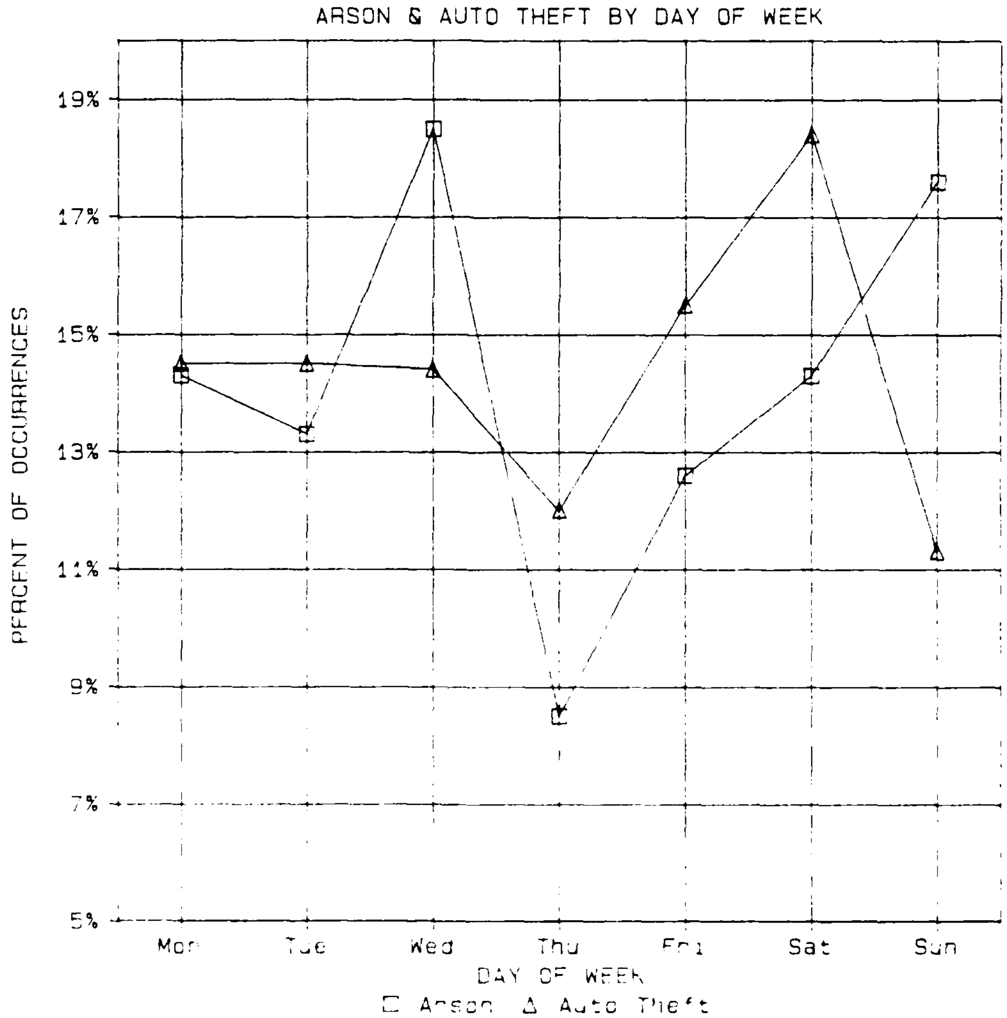


Fig. 7.



BURGLARY & LARCENY BY DAY OF WEEK
17%
16%
15%
14%
13%
12%
11%
PERCENT OF OCCURRENCES
Mon
Tue
Wed
Thu
Fri
Sat
Sun
DAY OF WEEK
◇ Burglary X Larceny

Fig. 8.


ARSON & AUTO THEFT BY DAY OF WEEK
19%
17%
15%
13%
11%
9%
7%
5%
PERCENT OF OCCURRENCES
Mon
Tue
Wed
Thu
Fri
Sat
Sun
DAY OF WEEK
□ Arson △ Auto Theft

in its ability to enhance our explanation of the variance--but it must now be variance over a finer grid. By adding seven days or six time "slices" (the third dimension) to the urban fabric, the regression equation must now operate with six or seven times more specificity. It would hardly be an accurate test to compare the space-time regression run results with those discussed during the validation step.

Space-Time Unit Analysis

What is required is a base level of explanation (R^2), that is attributable to the socioeconomic variables alone, but that operates on the finer grid. This grid is structured by replicating the fifty-two census tracts for each of the six four-hour time blocks. Thus a matrix of 312 rows (space-time units) was developed from which to determine this base level.

The matrix column headings were the same as those final variables that had been derived during the validation step and found to be significant with the T-Test. These constant characteristics of each tract, in terms of the three socioeconomic variables, are the same in each of six rows, each coded as a separate space-time unit in x,y,t space. The columns of crime rate data are also calculated separately for each space-time unit (STU). The space-time unit data matrix is included in Appendix E.

Each regression was run with only the three independent variables and the standardized residuals were plotted. It was readily apparent, upon examining the extreme residuals, that the addition of a time factor would enhance the explanatory value of the equations. For example, the ten highest standardized residuals for the initial run on the total violent crime rate were all from the 19:00 to 23:00 and 23:00 to 03:00 time frames. Eight of the ten highest residuals for property crime were clustered in the 15:00 to 19:00 and 19:00 to 23:00 time blocks. This is, of course, consistent with Figures 1 through 3, showing peak occurrences of violent crimes and property crimes.

During the next phase the time slices were added as independent variables in the regression equation. The 03:00 to 07:00 time block was habitually the lowest in terms of crime rate, so it was not entered into the equation, but rather collapsed into the constant term. This was necessary to avoid creating a perfectly conditioned matrix when the time variables were entered as binary, categorical variables.

Any four-hour time block that did not test significant at the .05 level during the regression run was deleted as a binary variable and (by default) included in the constant term on the subsequent run. This generally resulted in an equation that tested (F-Test) significant at the .01 level and for which all independent variables

left in the equation tested (T-Test) as significant at least at the .05 level, and in most cases at the .01 level. The only exception was the homicide rate which, owing to the small numbers involved, proved to be problemmatic. Comparison of the regression results before and after addition of the time blocks as independent variables is provided in Appendix F.

Given the F-Test and T-Test constraints indicated above, table 10 summarizes the increased R^2 value attributable to the addition of the time blocks.

TABLE 10

R^2 VALUE ENHANCEMENTS DUE TO TIME BLOCKING

Crime Rate	R^2 Before	R^2 After
Violent Crime	.398	.591
Homicide	n/a	n/a
Rape	.153	.217
Robbery	.304	.415
Assault	.382	.578
Property Crime	.569	.705
Burglary	.560	.631
Larceny	.508	.657
Auto Theft	.352	.524
Arson	.244	n\a

While these results may not seem to be astounding when compared to the roughly 80 percent explanation achieved with the socioeconomic variables during the validation step, it must be remembered that the space-time analysis provides a much greater degree of specification having "sliced" the fifty-two census tracts "vertically" in

time. With this in mind, a 19 percent increase in the explanatory power of the model for violent crime and a 13 percent increase for property crime seems to be well worthwhile. Noteworthy results are discussed by crime type below.

Homicide

Attempts to formulate a meaningful regression equation for the crime of homicide were problemmatic. The low number of events (11) really does not justify conclusions regarding trends beyond those discussed earlier with respect to the area within New Circle Road. Although median family income, percent of land used for commercial purposes, and nonwhite percent of population had been potent in the equations for violent crime in the aggregate, and each of the other types of violent crime, this was not the case for homicide. Only median family income tested significant (.0269) with the T-Test and the R^2 value was only .046 (explaining only 4.6 percent of the variance).

Addition of the 19:00 to 23:00 time block, which had the highest mean rank on the Kruskal-Wallis test, boosted R^2 to only .067 (6.7 percent), and barely cleared the significance criteria gate (T=.0463). At best, it can be said that there is a slight tendency toward the late evening hours.

Rape

All three of the traditional correlates of violent crime tested as significant on the T-Test in the equation for rape, and the entire equation was significant (.0000) on the F-Test, explaining 15.3 percent of the variance. With the addition of all time blocks to the equation, R^2 increased to 21.8 percent, but the 07:00-11:00 and 11:00-15:00 time blocks were not significant. The final equation was determined by collapsing those two blocks into the constant term. The explanatory measure fell only slightly to 21.7 percent, with no loss in significance of the entire equation over what had been determined based on the socio-economic variables alone.

Significant, however, is a comparison of the BETA weights, with the time block 23:00-03:00 proving to be the most potent, followed by nonwhite percent of population, median family income, and commercial land use in that order. This is, of course, consistent with what was determined on the Kruskal-Wallis measure where the 23:00-03:00 time block returned the highest mean ranks.

Robbery

The base regression equation for robbery explained 30.4 percent of the variation in the distribution pattern, and commercial land use emerged as the most potent predictor, as expected. Addition of all the time blocks boosted the R^2 value to .427, but the daytime blocks (07:00

through 19:00) were not significant. The revised run resulted in an explanation value of 41.5 percent, tested significant for F at .0000, and showed the relative importance of time blocking. The 19:00-23:00 time block was second in potency behind commercial land use, and the 23:00-03:00 placed third in terms of importance.

Clearly the identification of these time blocks suggests crime prevention strategies which could be targeted at certain of the city's census tracts. Examination of the extreme residuals on this final run reveals that seven of the highest eight are in the two time blocks discussed above, with central-city tracts 01, 02 and 03 forming the nucleus of concern.

<u>Assault</u>

The base equation for assault explained 38.1 percent of the variance, and tested significant to four decimal places (.0000) for the three independent variables and the constant term (T-Test), and for the equation itself (F-Test). Addition of the time blocks increased the R^2 value to .583, but again the daytime blocks (07:00 through 15:00) were not significant.

Collapsing those daytime blocks into the constant term resulted in a final equation that explained 57.8 percent of the variance and that tested as very significant (.0000) on all the independent variables, including the remaining time blocks. The two late-night blocks (19:00-

23:00 and 23:00-03:00) were the most potent predictors, followed by nonwhite percent of population and the other two socioeconomic variables. The extreme residuals were also clustered in the late night and downtown space-time units.

All Violent Crime

Examination of the results concerning the aggregation of all crimes against persons yields results that are virtually identical to those discussed for assaults, above. This is, of course, a logical outcome recognizing that assaults constitute the largest category within violent crime.

Burglary

Burglary, like the other property crimes that follow, correlated with a slightly different set of socioeconomic variables that ultimately found a place in the base regression equations. Nonwhite percent of poulation dropped out as a significant predictor, and population density replaces it in the case of property crime. Also, the subsequent equations describe a rate that was computed on a per-square-mile basis, keeping in mind the earlier discussions regarding the crime gradient and the logical approach to viewing property as the "at-risk" population.

The base equation explained 56.0 percent of the variance and all independent variables tested significant at

the .0000 level (as did the total equation). Addition of the time blocks as independent variables boosted R^2 to 63.1 percent and only the 11:00-15:00 time block was not significant.

Collapsing that block into the constant term did not reduce the R^2 value, but in this case the time blocks followed the socioeconomic variables in terms of relative importance to the equation. The 15:00-19:00 time block was the fourth most potent factor, followed by the 19:00-23:00 time block. The five highest residuals were all from these two blocks and emphasized the central-city tracts.

<u>Larceny</u>

The base equation for larceny explained 50.8 percent of the variance, a figure that was increased to 65.7 percent with the addition of the time blocks. All of the time blocks tested significantly, and the 19:00-23:00 and 15:00-19:00 blocks placed second and third, respectively, behind commercial land use as the most potent predictor variables in the equation. The ten highest residual space-time units were all from these two blocks or from the CBD (or a combination of both).

Nowhere in the data do we see a stronger evidence of the "path and project" phenomena, expressed in terms of land use (commercial) and institutional time regimes. This, of course, is not a startling finding given a modicum

of common sense; but the statistical verification of that fact is reassuring.

Auto Theft

The base equation for auto theft explained 35.2 percent of the variance, and the addition of time blocks to the independent variable list increased this figure significantly (53.3 percent). The time blocks 07:00 through 15:00, however, did not test as significant, and the final run dropped to an R^2 value of .524 (52.4 percent). The time block 19:00-23:00 was far and away the most potent predictor variable, followed by commercial land use. The remaining socioeconomic variables (population density and median family income) were a distant third and fourth. Examination of the high residuals for the final equation reveals a strong tendency toward the late evening and central business district STUs.

All Property Crime

All time blocks proved significant in the equation for total property crime, and the base level of explanation (56.9 percent) was boosted to 70.5 percent. Discussion of the specifics regarding this aggregate rate parallel that of larceny. Since this rate is numerically dominated by both burglary and larceny (which in themselves present slightly different time profiles), detailed discussion of the aggregate rate is not presented.

Arson

Arson, as was mentioned earlier, can be a crime borne of different motivations. The targets of arson represent a mix of commercial and residential properties. The base equation for arson does not include commercial land use, testing significant only for population density and median family income. The addition of time blocks to that equation did not reveal any which tested as significant.

Space-Day Unit Analysis

A similar approach was used in adjusting successive runs for the space-day unit analyses. A matrix of 364 (52 census tracts x 7 days) rows was created, and the initial R^2 values were established using the three best socio-economic variables for the given rate type. The space-day unit data matrix is provided in Appendix G.

Subsequent regression runs included days of the week as binary categorical variables with, initially, only Monday collapsed into the constant term (to avoid creation of a perfectly conditioned matrix). Runs were repeated, with additional days added to the constant term, until the T-Test criteria of .05 for all independent variables was met. Comparison of the regression results before and after inclusion of the day variables is provided in Appendix H.

Table 11 summarizes the results achieved for the space-day unit analyses in terms of enhanced explanatory power.

TABLE 11

R^2 VALUE ENHANCEMENTS DUE TO DAY BLOCKING

Crime Rate	R^2 Before	R^2 After
Violent Crime	.601	.635
Homicide	n/a	n/a
Rape	.166	n/a
Robbery	.356	.361
Assault	.570	.613
Property Crime	.779	.787
Burglary	.664	.670
Larceny	.759	.764
Auto Theft	.437	.453
Arson	.224	n/a

Despite the fact that day groupings did not test as highly significant on the Kruskal-Wallis, a fact reflected in the modest R^2 improvements, there does appear to be some benefit to this type of analysis. Given the fact that most of the socioeconomic data speak little to the condition inside the home, it should not be surprising that the equations for homicide and rape are inconclusive. These are "close to home" crimes. Comparison of the regression analyses is provided by crime type below.

Homicide

As was the case with space-time units, the analysis of homicide rate variation among the space-day units was inconclusive. The day groupings, which tested less significantly than the time groupings on the Kruskal-Wallis, also performed poorly on the regression analysis.

No significant results worthy of exploration were detected during the regression analysis.

Rape

Kruskal-Wallis testing of the day groupings suggested that comparison of Saturday with all other days was significant with respect to rape rates. This was not true of the regression analysis where neither Saturday (as an expected high) nor Thursday (as an expected low) proved to be a statistically significant predictor variable.

Robbery

Although a slight improvement in the R^2 value was achieved by adding days to the equation for robbery, the days did not test significant with the T-Test and thus the results are meaningless.

Assault

The base level of explanation achieved for the assault rate (using nonwhite percent of population, median family income, and commercial land use) was 56.9 percent. The addition of the weekend days, as suggested by the Kruskal-Wallis analysis, increased this value, but only the Saturday variable proved to be significant.

Repeating the analysis with all days except Saturday collapsed into the constant term, the equation returned an R^2 value of .613 (61.3 percent), but in terms of importance, the Saturday identification of space-day units

lagged behind all three of the socioeconomic variables. High residual values are also associated strongly with Saturday and the high commercial land use areas.

<u>All Violent Crime</u>

Because of the numerical dominance of assault in the violent crime rate, the discussion regarding total violent crime parallels that of assaults, above. It should be mentioned at this point that, following each of the structured (theory-based) regression analyses, a searching attempt was made using the stepwise multiple regression technique. This was done to assess the possible significance of any of the other initial seven variables when used in combination with the time/day variables.

In this case statistical exploration did turn up another variable suitable for inclusion in the discussion--industrial land use. Addition of the industrial land use variable to the set of independent variables tested as significant within the criteria established (T=.0030) and boosted the explanation of the violent crime rate to 64.4 percent. This is not seen as a significant increase, but it does verify one of the hypotheses that was not supported when examining the fifty-two census tracts during the validation stage.

This finding suggests that further analyses might be conducted with variables that represent interaction terms of the equation.

Burglary

Burglary presented a situation that was not expected with respect to day blocking. During the Kruskal-Wallis testing day blocking, even with the peak day--Friday--measured against all others, did not test significantly. When added to the regression equation, however, the Friday identification did test significantly with the T-Test. As might be expected, however, it displayed the weakest of the BETA weights, and boosted the explanatory value of the total equation only a fraction of a percent (from 66.4 to 67.0).

Larceny

Larceny can be discussed in similar terms, however in this case Sunday (a low, not a peak) proved to be significant as an independent variable in the equation. It was the least potent of the predictor variables and accounted for an increase in R^2 from .759 to .764. As more businesses opt to stay open on Sunday, this difference may cease to be significant at all.

Auto Theft

Only Saturday proved to be a significant day variable for auto theft, an expected outcome given the preliminary analysis with Kruskal-Wallis. Addition of the Saturday identification to the set of independent variables boosted the explanatory power of the model from 43.7 percent to

45.3 percent but, as would be expected, the day variable ranked far behind commercial land use, median family income, and population density in terms of its importance to the equation.

All Property Crime

The total property crime rate, dominated as it is by the larceny rate, returned broadly similar results. The Sunday identification represented a reduction in the rate that corresponded to an eight-tenths of one percent improvement in the R^2 value.

Arson

While the Wednesday peak and Thursday low had been observed on a day graph for arson, these day identifications did not contribute significantly to the regression analysis of arson rates within the county. Population density and median family income (inverse relationship) remained the only two significant predictor variables in the equation.

Journey-to-Crime Implications

One of the original objectives of this study was to examine the interplay between regions of crime occurrence and source regions of criminals within the county. Because of late recovery of and inconsistency in the offender data set, this objective was dropped. The distribution of

crimes in the county, however, does suggest that this is an area suitable for further investigation.

Table 12, below, summarizes those inner-city census tracts in terms of their placement within the upper quartile (groups 4 and 5) for each crime type. There is an apparent geographical separation among three generalized groups: those with both high violent crime and high property crime, those with only high property crime (perhaps a spillover?), and those with a mix of lower rates in both.

TABLE 12

CENSUS TRACT GROUPINGS BY CRIME TYPE

Tract	Homic.	Rape	Robry.	Asslt.	Burg.	Larc.	Auto	Arson
01 *	4	5	5	5	5	5	5	5
02 *	4	4	5	4	4		5	4
03 *		5	5	5	5	4	4	5
04 *	4	4	4	5	5	4	5	
05 **					4	4		4
06 **					4			
07 **					4	5		
08 **					4		4	5
09 *	5	5	4	5	5	4	4	4
10	4	4		4				
11		4		4	4			
12		5	5	5		4		
13			5	4	4	5		
14 *	4		4	4	4	5	4	4
15		4	4	4		4	5	
16	4		4			4	4	4
17						4		
18		4	4		5	4	4	

Recognition of the potential for spillover provides a clue as to why ecological studies have been little disturbed by signs of spatial autocorrelation in the data. Indeed, the approach taken in this study assumes both

spatial and temporal autocorrelation, recognizing that certain types of crime, such as burglary, take on a "spree" characteristic where the fruits of several crimes are fenced within minutes and blocks of the crime event.

Testing the regressions for serial autocorrelation with the Durbin-Watson statistic generally showed a lack of first order autocorrelation (homicide, rape, larceny, arson, and burglary) or returned a value that was in the inconclusive range (assault, robbery, and auto theft). This measure does not speak to the more probable case--spatial autocorrelation--a condition for which measurement techniques are still evolving. The posibility of spatial-temporal autocorrelation is not seen as a shortcoming, however, given the ecological nature of the study and the universe of data obtained.

Interpretation of such spatial groupings, in terms of opportunity versus motivation theory, and fundamental differences between property crime patterns and violent crime patterns, would certainly lend support to the spillover conclusion.

Those six census tracts marked with a single asterisk (*) should be familiar by now. Ranked high in both violent crime and property crime, they form a continuous area in the CBD and the near north side. From the evidence at hand it would seem that this is both a source region and an

event region--one that combines those factors of opportunity and motivation in close proximity.

The second group, those marked with a double asterisk (**), form a continuous group that borders the CBD on the southeast and south. They appear to be the receivers of crime spillover from the CBD and near north side, with opportunity factors coming to the forefront. Map 22 summarizes the juxtaposition of these two areas.

The above analysis is a crude one, and further detail on offender residences is required before convincing conclusions can be reached. The need for such analysis, however, is apparent, and the collection and processing of such data is well within the capabilities of the Lexington-Fayette Urban County Division of Police.

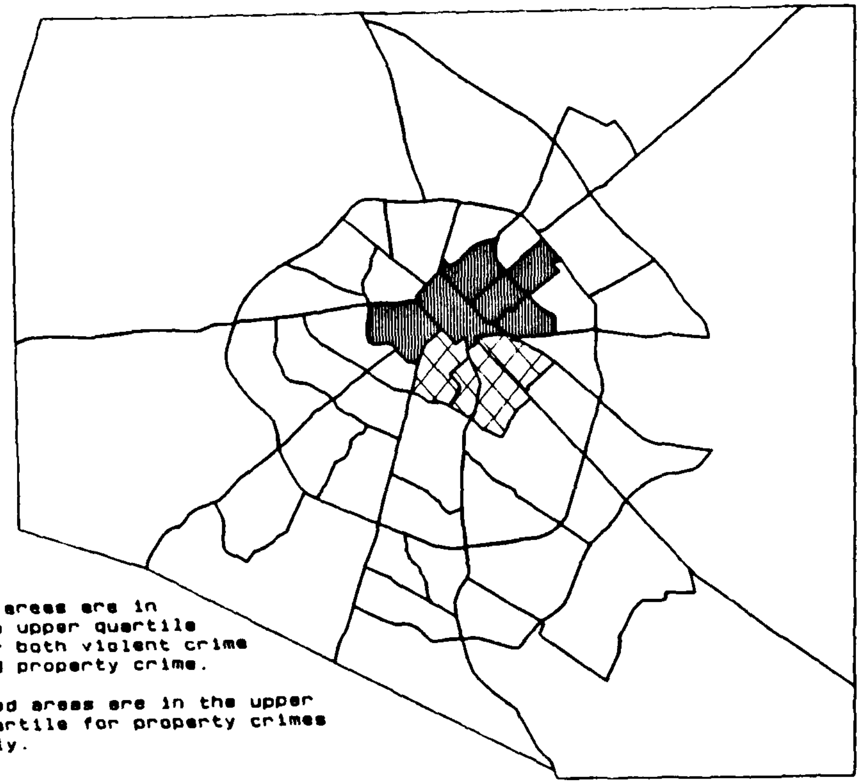
Summary

This analysis demonstrates that the intraurban distribution of crime in Lexington, a medium-sized city, is not unlike that discussed in the preponderance of the ecological literature about larger cities, and that the same socioeconomic variables emerge as correlates of crime. It has further been shown that the addition of time, in a cyclical sense, can add to the understanding of that distribution as it relates to the pattern for specific crime types.

Extending these findings to other cities requires analyses that are targeted at urban places which present

COMPARISON OF HIGH CRIME AREAS

Fayette County, Kentucky



Solid areas are in the upper quartile for both violent crime and property crime.

Hatched areas are in the upper quartile for property crimes only.

Map 22.

different profiles. Harries' (1974) analysis of interurban variation in crime rates suggests that the employment characteristics of a given city can serve to explain differences in magnitude and type of crime. Cities that, for example, employ larger percentages of factory shift workers could be expected to display a temporal signature of individual paths and institutional projects that differs significantly from that of Lexington. The technique of using space-time units to measure such variations, however, should be applicable to a wide variety of employment profiles.

Chapter VI offers conclusions regarding the applicability of space-time analyses to other social phenomena in the urban landscape, and presents specific recommendations for the use of such an approach by the Lexington-Fayette Urban County Division of Police in their development of a spatial analysis capability.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Recognition of the established correlates of crime in the case of Fayette County supports a conclusion that the medium-sized city and its environs is a viable candidate for study of the nature and distribution of urban crime. While city size probably plays a role in the actual magnitude of the crime rate, conclusions regarding the causes of a differential distribution of crime within the city appear to be independent of the size variable.

Having examined the distribution of socioeconomic variables and crime within the county, several aspects of that distribution seem obvious. First, the influence that high population density, low family economic status, ethnicity (as approximated by a white/nonwhite dichotomy), and high commercial land use all exert on the crime rate is evident. What is less evident is what can be done about it.

Zoning commissions and land-use planners must come to recognize the inherent folly in concentrating the potential for high crime rates in a given area. When the landowners

of Chevy Chase lobby against a particular commercial enterprise, arguing that they wish to preserve the traditional character of the neighborhood, the net result is that some other part of the city may ultimately play host to the new business. If preserving the traditional character of one neighborhood means segregating commercial, industrial, and residential land uses, the results could be disastrous.

The spillover effect of a concentrated corridor of crime may well be worse than the diluted effect of spreading out such functions. This is an area ripe for further investigation. It would appear that the problem now facing those residents of the traditional neighborhoods in the near southeastern sector is not an internal one, but a real one nonetheless.

The message should be obvious, also, that social programs designed to preserve family stability and reduce unemployment, that foster assimilation of minority populations, and that seek to provide adequate housing for the urban, low-income dweller, benefit a much larger segment of the population than that to which such programs are directed.

The evidence also supports the conclusion that, to the extent that forces are deployed as a deterrent or response to crime, the combined spatial/temporal analysis of incidents can be an aid to law enforcement planners. The addition of the temporal element, new only in terms of

the technique used, would appear to be a valuable supplement to traditional methods for planning beat areas and patrol times. A modest 13 to 19 percent increase in the ability to predict crime occurrence within a four-hour/census-tract space-time unit may well be a worthwhile, low cost planning tool.

Clearly the use of space-time units holds more promise than does an analysis by days of the week. Fortunately, however, the daily cycle represents a planning factor over which the police and other urban managers exercise the greatest degree of control. The greatest benefit may well be the enhanced ability to target specific teams that can act as both a deterrent to crime and a reassurance to proprietors and homeowners.

Recommendations

The technique for displaying data contained in this paper is within the capability of the Lexington-Fayette Urban County Division of Police. Development of that capability would serve a number of purposes within the division, not the least of which is real-time display of recent trends by crime type, location, or time. The information is available, either within the criminal incident and suspect files, or from the other elements of county government.

In order to bring the capability on board, a number of tasks must be accomplished:

1. Software Acquisition. The communications division already has the software necessary for downloading from the IBM System 38 to the microcomputer. Microcomputer-based programs should be obtained that can produce maps and graphs similar to those contained in this paper. The two programs used for this project retail for under $1,000 and the market is being flooded with competitors.

2. Hardware Acquisition. The division microcomputers are capable of handling the programs, have the display capability, and only a plotter for hard-copy output (paper or transparency) would be required. The plotter used to draw all the maps and graphs in this paper retails for under $1,900.

3. Data Base Importation. Boundary files for drawing outlines of the county map and centroid locations for both census tracts and coded blocks should be drawn from the DIME file (state-plane coordinate system) maintained by the county planners. Although the maps prepared for this paper were taken from a digitized base map, establishing the state-plane coordinate base map would facilitate updates as peripheral areas develop and census tracts are subdivided.

4. Data Base Update. Incident and suspect files which were maintained on the old system (and upon which

this paper was based) should be updated as soon as possible and merged with the current files on the main police computer (IBM System 38). At the present time the division can access less than a year of real-time data, and supplemental information on the 1983 - 1985 files cannot be posted.

5. Data Base Procedure Changes. The incident and suspect files contain a wealth of information of value to police and scholars alike. Only minor changes are required.

(a) The case record numbers are currently assigned in MMDD###YYA format, where 061722286B would be a report on the second (B) offense on the 222nd report opened on the 17th day of June, 1986. This means that the reports for New Year's Day, 1983 are right next to those for 1984. In the name of rapid retrieval and sorting of longitudinal data sets, the conventional wisdom would initiate a system based on YYMMDD###A, where adjacent data are chronological and numerical sorting is more efficient.

(b) Both the Incident File and the Suspect File contain geographic information, however it is apparently a duplication of effort. When the census tract and block code are entered in the record, the coding manual for both files directs the data entry clerk to block# 20 of the C & O Report (the written incident record). To facilitate studies pertaining to journey-to-crime and the identifi-

cation of source areas for criminals, it would help if the suspect file were coded for the tract and block of residence of the offender, not the location of the incident. The incident location can always be obtained by searching the incident file using the key field (case record number) which is in the suspect file.

Theoretical Implications

While the case study aspect of this analysis should benefit the law enforcement profession, there are theoretical implications that reach well beyond Lexington and crime patterns. Spacing and timing activities in the city, even through the relatively unsophisticated technique used in this study, hold promise for a more complete understanding of urban phenomena. Just as one might talk of a need for "urban green-space" to break up the city's concrete environment, it may well be that planners can temper the pace of city life, especially as it relates to institutional projects, and afford some temporal respite from the rigors of urban living.

Clearly the careful scheduling of certain activities, in terms of both time and space, can serve to avoid those space-time units which seem to represent peak conditions for crime. In a similar manner, social/behavioral scientists might undertake to analyze the use of time-space by the city's elderly, or work to aid urban planners in optimizing the provision of basic services--such as mass

transit. What is needed is a clearer understanding of the interplay among social structure characteristics, land use, and time. Space-time units afford one means of examining the city in the difficult dual contexts of space and time.

It is clear, too, that census-like data are not completely adequate for these types of analysis. While "slicing" the urban environment by time segments appears to partially avoid the nighttime bias of census data, it is less than optimal, and greater use of surveys that can serve to describe the actual makeup of a city at a given time is strongly encouraged.

APPENDIX A

OPERATIONAL DEFINITIONS OF INDEX CRIMES

Class I Offenses are used in this study in that they represent the more serious crimes and are generally the most frequently reported crimes. The definitions below were extracted from the Uniform Crime Report 1980.

Criminal Homicide

(a) Murder and nonnegligent manslaughter includes all willful felonious homicides as distinguished from deaths caused by negligence. Does not include attempts to kill, assaults to kill, suicides, accidental deaths, or justifiable homicides. Justifiable homicides excluded from this classification are limited to the following types of cases: (1) the killing of a felon by a peace officer in the line of duty; (2) the killing of a holdup man by a private citizen. (b) Manslaughter by negligence includes any death which the police investigation establishes was primarily attributable to gross negligence on the part of some individual other than the victim.

Rape

Includes forcible rape, statutory rape (no force used--victim under age of consent), assault to rape, and attempted rape.

Robbery

Includes stealing or taking anything of value from the person by force or violence or by putting in fear, such as strong-arm robbery, stick-ups, robbery armed. Includes assault to rob and attempt to rob.

Aggravated Assault

Includes assault with intent to kill; assault by shooting, cutting, stabbing, maiming, poisoning, scalding, or by the use of acids. Does not include simple assault, assault and battery, fighting, etc.

Burglary--breaking or entering

Includes burglary, housebreaking, safe-cracking, or any unlawful entry to commit a felony or a theft, even though no force was used to gain entrance. Includes attempts. Burglary followed by a larceny is included in this classification and not counted again as larceny.

Larceny--theft (except auto theft)

(a) Fifty dollars and over in value; (b) under fifty dollars in value. Includes in either of the above subclassifications, depending upon the value of the property stolen, thefts of bicycles, automobile accessories, shoplifting, pocket-picking, or any stealing of property or article of value which is not taken by force and violence or by fraud. Does not include embezzlement, "con" games, forgery, worthless checks, etc.

Auto Theft

Includes all cases where a motor vehicle is stolen or driven away and abandoned, including the so-called "joy-riding" thefts. Does not include taking for temporary use when actually returned by the taker, or unauthorized use by those having lawful access to the vehicle.

APPENDIX B

KRUSKAL-WALLIS ANALYSIS OF VARIANCE

The Kruskal-Wallis test is a non-parametric one-way analysis of variance suitable for use on skewed data sets. The Kruskal-Wallis test ranks all cases from the k groups in a single series, computes the rank sum for each group, and computes the Kruskal-Wallis H statistic, which has approximately a chi-square distribution when there are more than five cases in each group. The formula follows:

$$H = \frac{\left(\dfrac{12}{N(N+1)}\right)\left(\displaystyle\sum_{i=1}^{k} \frac{R_i^{2}}{N_i}\right) - 3(N+1)}{1 - \quad T_i \;/\; N^3 - N}$$

Where:

N_i = the number of cases in the ith group

N = the total number of cases in the sample

$T_i = t_i^{3} - t_i$

t_i = the number of ties for rank i

The H statistic can be tested for significance using the Chi Square table with df=k-1.

The null hypothesis tested states that the difference in the mean ranks is a chance occurrence.

APPENDIX C

KRUSKAL-WALLIS RESULTS FOR TIME BLOCKS

Homicides per 100,000 Cases = 312

Time Slice	Mean Rank	Cases	Corrected for Ties
0301-0700	151.00	52	
0701-1100	153.92	52	Chi-Square:
1101-1500	153.98	52	6.1326
1501-1900	157.10	52	
1901-2300	162.98	52	Significance:
2301-0300	160.02	52	0.2935

Rapes per 100,000 Cases = 312

Time Slice	Mean Rank	Cases	Corrected for Ties
0301-0700	132.03	52	
0701-1100	145.19	52	Chi-Square:
1101-1500	137.91	52	16.8101
1501-1900	171.70	52	
1901-2300	167.87	52	Significance:
2301-0300	184.30	52	0.0049

Robberies per 100,000 Cases = 312

Time Slice	Mean Rank	Cases	Corrected for Ties
0301-0700	143.46	52	
0701-1100	102.87	52	Chi-Square:
1101-1500	144.02	52	47.8920
1501-1900	151.53	52	
1901-2300	196.61	52	Significance:
2301-0300	200.52	52	0.0000

Assaults per 100,000 Cases = 312

Time Slice	Mean Rank	Cases	Corrected for Ties
0301-0700	97.23	52	
0701-1100	101.46	52	Chi-Square:
1101-1500	136.24	52	87.1412
1501-1900	186.80	52	
1901-2300	208.32	52	Significance:
2301-0300	209.91	52	0.0000

Violent Crimes per 100,000 Cases = 312

Time Slice	Mean Rank	Cases	Corrected for Ties
0301-0700	94.98	52	
0701-1100	100.61	52	Chi-Square:
1101-1500	137.75	52	90.2162
1501-1900	180.82	52	
1901-2300	210.61	52	Significance:
2301-0300	214.24	52	0.0000

Burglaries per Square Mile Cases = 312

Time Slice	Mean Rank	Cases	Corrected for Ties
0301-0700	119.08	52	
0701-1100	153.71	52	Chi-Square:
1101-1500	140.64	52	19.4786
1501-1900	188.46	52	
1901-2300	174.74	52	Significance:
2301-0300	162.37	52	0.0016

Larcenies per Square Mile Cases = 312

Time Slice	Mean Rank	Cases	Corrected for Ties
0301-0700	77.46	52	
0701-1100	129.64	52	Chi-Square:
1101-1500	162.65	52	71.3940
1501-1900	198.53	52	
1901-2300	204.53	52	Significance:
2301-0300	166.18	52	0.0000

Auto Theft per Square Mile Cases = 312

Time Slice	Mean Rank	Cases	Corrected for Ties
0301-0700	99.21	52	
0701-1100	124.99	52	Chi-Square:
1101-1500	146.05	52	55.7326
1501-1900	173.19	52	
1901-2300	214.92	52	Significance:
2301-0300	180.63	52	0.0000

Property Crime per Square Mile Cases = 312

Time Slice	Mean Rank	Cases	Corrected for Ties
0301-0700	88.50	52	
0701-1100	134.89	52	Chi-Square:
1101-1500	155.46	52	54.2296
1501-1900	194.50	52	
1901-2300	199.63	52	Significance:
2301-0300	166.01	52	0.0000

Arson per Square Mile Cases = 312

Time Slice	Mean Rank	Cases	Corrected for Ties
0301-0700	149.67	52	
0701-1100	146.74	52	Chi-Square:
1101-1500	134.93	52	14.7607
1501-1900	165.06	52	
1901-2300	183.10	52	Significance:
2301-0300	159.50	52	0.0114

APPENDIX D

KRUSKAL-WALLIS RESULTS FOR DAYS

Homicides per 100,000 Cases = 364

Day	Mean Rank	Cases	Corrected for Ties
All Others	181.09	312	Chi-Square:
Friday	190.95	52	4.4506
			Significance:
			0.0349

Rapes per 100,000 Cases = 364

Day	Mean Rank	Cases	Corrected for Ties
All Others	179.23	312	Chi-Square:
Saturday	202.09	52	6.0121
			Significance:
			0.0213

Robberies per 100,000 Cases = 364

Day	Mean Rank	Cases	Corrected for Ties
All Others	185.25	156	Chi-Square:
Wednesday	165.06	52	7.7480
Thursday	159.69	52	Significance:
Friday	192.13	52	0.1013
Saturday	204.87	52	

Assaults per 100,000 Cases = 364

Day	Mean Rank	Cases	Corrected for Ties
All Others	176.41	156	Chi-Square:
Monday	156.23	52	10.0044
Friday	183.02	52	Significance:
Saturday	217.89	52	0.0404
Sunday	191.13	52	

Violent Crimes per 100,000 Cases = 364

Day	Mean Rank	Cases	Corrected for Ties
All Others	174.64	156	Chi-Square:
Monday	164.46	52	9.4498
Friday	180.38	52	Significance:
Saturday	220.81	52	0.0508
Sunday	187.91	52	

Burglaries per Square Mile Cases = 364

Day	Mean Rank	Cases	Corrected for Ties
All Others	180.02	312	Chi-Square:
Friday	197.38	52	1.2124
			Significance:
			0.2708

Larcenies per Square Mile Cases = 364

Day	Mean Rank	Cases	Corrected for Ties
All Others	181.74	208	Chi-Square:
Friday	191.55	52	2.0421
Saturday	192.38	52	Significance:
Sunday	166.60	52	0.5637

Auto Theft per Square Mile Cases = 364

Day	Mean Rank	Cases	Corrected for Ties
All Others	179.82	312	Chi-Square:
Saturday	198.52	52	6.1242
			Significance:
			0.0199

Property Crime per Square Mile Cases = 364

Day	Mean Rank	Cases	Corrected for Ties
All Others	181.22	208	Chi-Square:
Friday	194.13	52	2.6682
Saturday	193.49	52	Significance:
Sunday	165.02	52	0.4457

Arson per Square Mile Cases = 364

Day	Mean Rank	Cases	Corrected for Ties
All Others	183.37	260	Chi-Square:
Wednesday	191.53	52	2.2022
Thursday	169.12	52	Significance:
			0.3325

APPENDIX E

SPACE-TIME UNIT DATA MATRIX

STU PopDen Nonwh% MedFam$ Comm% Indu% Homic Asslt
Rape Burglary Arson Larceny Robbery
AutoTh ViolCrm PropCrm 7-11 11-15 15-19 19-23 23-03 Time

100.07 7437 25.7 9246 47.1 10.2 0 401.3646
40.13646 82.08956 1.492537 177.6119 80.27293
22.38806 521.7741 282.0896 1 0 0 0 0 2

200.07 6338 48.8 11747 10 21.2 0 339.8058
48.54369 38.46154 1.538462 33.84615 24.27185
7.692308 412.6214 80 1 0 0 0 0 2

300.07 10478 71.3 10153 9.7 5.4 0 256.0522
69.8324 65.85366 2.439025 48.78049 23.27747
0 349.162 114.6342 1 0 0 0 0 2

400.07 10239 75.1 5479 9.5 29.5 0 227.1179
22.71179 51.16279 0 41.86047 22.71179
6.976744 272.5415 100 1 0 0 0 0 2

500.07 7109 4.1 15993 11.5 3.6 0 92.22965
0 34.42623 0 45.90164 0
3.278689 92.22965 83.60655 1 0 0 0 0 2

600.07 6044 .8 25758 10.8 0 0 0
0 14.47368 0 22.36842 0
0 0 36.84211 1 0 0 0 0 2

700.07 7300 1.7 18806 16.7 0 0 94.47331
0 55.17242 0 48.27587 0
0 94.47331 103.4483 1 0 0 0 0 2

800.07 12747 6.2 9667 2.2 0 0 12.06855
0 13.84615 0 35.38462 0
9.230769 12.06855 58.46154 1 0 0 0 0 2

900.07 3834 28.4 7866 8.8 30.4 0 107.1811
71.45409 34.24658 1.369863 64.38356 71.45409
8.219178 250.0893 106.8493 1 0 0 0 0 2

1000.07 2535 21.6 13057 5 67.2 0 74.40476
0 3.773585 0 11.32076 0
0 74.40476 15.09434 1 0 0 0 0 2

1100.07 5459 75.1 11629 7 12.9 16.96065 101.7639
0 19.44444 0 12.03704 0
0 118.7246 31.48148 1 0 0 0 0 2

1200.07 456 8.5 8888 18.5 62.6 0 384.6154
384.6154 1.754386 0 26.31579 0
1.754386 769.2308 29.82456 1 0 0 0 0 2

1300.07 5035 9.100001 14567 27.3 16.6 0 53.67687
0 18.91892 0 102.7027 53.67687
8.108108 107.3537 129.7297 1 0 0 0 0 2

1400.07 7419 8.899999 13782 10 0 0 32.87311
0 39.02439 4.878049 46.34147 0
4.878049 32.87311 90.24391 1 0 0 0 0 2

1500.07 3840 10.5 17607 22.6 30.5 0 120.1923
40.0641 12.30769 0 32.30769 0
4.615385 160.2564 49.23077 1 0 0 0 0 2

1600.07 4295 3.4 16702 19.4 21.8 0 38.16794
0 18.03279 0 26.22951 0
1.639344 38.16794 45.90164 1 0 0 0 0 2

1700.07 3293 1.3 21991 17.8 5.5 0 37.02333
0 8.536586 0 37.80488 37.02333
2.439025 74.04666 48.78049 1 0 0 0 0 2

1800.07 6745 3.8 12159 11.9 20.8 0 44.92363
0 48.48485 0 54.54545 0
6.060606 44.92363 109.0909 1 0 0 0 0 2

1900.07 3970 10.3 14875 13.1 0 0 32.28931
0 0 0 11.53846 0
0 32.28931 21.79487 1 0 0 0 0 2

2000.07 6280 7.5 18270 6.4 2.1 0 53.97383
0 12.71187 .8474576 17.79661 0
4.237289 53.97383 34.74577 1 0 0 0 0 2

2100.07 41 0 8888 2.1 92 0 5882.353
2941.177 1.219512 0 24.39024 0
0 8823.529 25.60976 1 0 0 0 0 2

2200.07 4553 3.6 23317 11.2 19.5 0 0
0 2.564103 0 17.94872 0
0 0 20.51282 1 0 0 0 0 2

2301.07 3100 2.9 40048 3.4 0 0 29.59018
14.79509 4.587156 0 6.880734 0
.4587156 44.38526 11.92661 1 0 0 0 0 2

2302.07 2652 2.6 31691 3.8 0 0 0
30.90235 3.278689 0 2.459016 0
.8196721 30.90235 6.557377 1 0 0 0 0 2

2400.07 3212 4.2 29130 2.3 0 0 19.82947
0 2.547771 0 4.458599 0
0 19.82947 7.006369 1 0 0 0 0 2

2500.07 5060 2.8 20908 16 4 0 162.4256
0 10.9589 0 28.76712 0
4.109589 162.4256 43.83562 1 0 0 0 0 2

2600.07 4882 1.8 21442 8.7 0 0 0
0 7.692308 .9615385 16.34616 0
.9615385 0 25 1 0 0 0 0 2

2700.07 4704 3.7 28340 16.5 0 0 23.10536
0 8.695652 0 20.65217 23.10536
1.086957 46.21072 30.43478 1 0 0 0 0 2

2800.07 3622 2.5 22528 19.2 12.9 0 46.00874
0 10 0 20.83333 0
.8333333 46.00874 31.66667 1 0 0 0 0 2

2900.07 3857 .8 22711 4.8 0 0 23.14815
0 2.678572 0 8.928572 0
.8928571 23.14815 12.5 1 0 0 0 0 2

3000.07 4040 1.8 22851 14 0 0 46.11837
0 4.347826 0 19.87578 15.37279
0 61.49116 24.2236 1 0 0 0 0 2

3101.07 3566 5.3 19101 1.5 0 0 79.3441
52.89606 10.37736 0 8.490566 0
1.886793 132.2402 20.75472 1 0 0 0 0 2

3102.07 4481 9.100001 23089 5.9 0 0 64.68305
32.34153 33.33333 0 17.3913 0
2.898551 97.02458 53.62319 1 0 0 0 0 2

3200.07 4553 3.8 22464 4.8 0 0 30.28926
0 13.7931 1.37931 8.965517 0
1.37931 30.28926 24.13793 1 0 0 0 0 2

3300.07 3686 7 18304 10.9 1.2 0 141.844
35.46099 9.150327 0 14.37909 106.383
1.960784 283.6879 25.4902 1 0 0 0 0 2

```
3401.07  5190  8.100001  22306  2.5  0  0  47.68717
9.537434  17.82178  0  9.900991  9.537434
.4950495  66.76204  28.21783  1  0  0  0  0  2

3402.07  3002  5.1  18457  15.2  0  0  43.82121
0  9.210526  0  6.578948  0
0  43.82121  15.78948  0  0  0  0  0  2

3403.07  1063  7.7  22449  2.1  0  0  0
0  2.380952  0  4.421769  0
0  0  6.802721  1  0  0  0  0  2

3501.07  6654  2.9  20938  19.1  0  0  81.96721
27.32241  7.272727  0  32.72727  0
0  109.2896  40  1  0  0  0  0  2

3502.07  5265  5.8  19259  .2  0  0  0
0  20.89552  0  8.955224  0
2.985075  0  32.83582  1  0  0  0  0  2

3600.07  2326  1.8  36453  4.9  0  0  0
0  2.649007  0  1.986755  0
.6622516  0  5.298013  1  0  0  0  0  2

3700.07  113  21.6  22661  .1  9.7  0  54.37738
0  .2479083  0  .5577936  0
3.098853E-02  54.37738  .8366905  1  0  0  0  0  2

3801.07  1798  66.7  15238  1.4  5.5  0  118.5771
0  7.345972  .2369668  10.90048  13.17523
.7109005  131.7523  18.95735  1  0  0  0  0  2

3802.07  61  7.2  18723  .6  .1  0  35.99712
0  .2420242  0  .220022  0
.0440044  35.99712  .5060506  1  0  0  0  0  2

3901.07  2453  13.7  17350  21.2  26.2  0  29.32552
58.65103  9.352518  .7194245  12.94964  0
1.438849  87.97654  23.74101  1  0  0  0  0  2

3902.07  68  6.8  18277  1  2.9  0  22.11411
22.11411  .3032141  .0151607  .3032141  0
.1061249  44.22822  .7125531  1  0  0  0  0  2

4001.07  3992  14.3  17848  .3  0  0  108.9028
0  14.13044  0  5.434783  0
1.086957  108.9028  20.65217  1  0  0  0  0  2

4002.07  52  1.9  19402  .2  1.2  0  53.16321
53.16321  .3073484  0  .3073484  0
2.794077E-02  106.3264  .6426376  1  0  0  0  0  2
```

4101.07 3241 3.8 22121 4.5 0 0 0
0 6 0 4 0
0 0 10 1 0 0 0 0 2

4102.07 983 3 27256 .5 0 0 38.09524
0 1.123596 0 .3745318 0
0 38.09524 1.498127 1 0 0 0 0 2

4201.07 1165 3.1 27924 6.1 20.3 0 0
0 1.004016 0 6.024097 0
.4016064 0 7.429719 1 0 0 0 0 2

4202.07 89 14.3 25219 10 0 0 0
80.58018 .217549 0 .3625816 0
7.251631E-02 80.58018 .6526468 1 0 0 0 0 2

100.11 7437 25.7 9246 47.1 10.2 0 441.5011
120.4094 53.73134 1.492537 282.0896 361.2282
19.40299 923.1387 355.2239 0 1 0 0 0 3

200.11 6338 48.8 11747 10 21.2 0 388.3495
24.27185 29.23077 0 50.76924 97.08738
0 509.7088 80 0 1 0 0 0 3

300.11 10478 71.3 10153 9.7 5.4 0 395.717
0 65.85366 4.878049 58.53659 93.10987
9.756098 488.8268 134.1464 0 1 0 0 0 3

400.11 10239 75.1 5479 9.5 29.5 22.71179 363.3886
22.71179 32.55814 0 53.48838 45.42358
6.976744 454.2358 93.02326 0 1 0 0 0 3

500.11 7109 4.1 15993 11.5 3.6 0 46.11483
0 9.836065 0 39.34426 23.05741
0 69.17225 49.18033 0 1 0 0 0 3

600.11 6044 .8 25758 10.8 0 0 0
0 25 0 28.94737 0
1.31579 0 55.26316 0 1 0 0 0 3

700.11 7300 1.7 18806 16.7 0 0 141.71
0 20.68966 0 131.0345 0
3.448276 141.71 155.1724 0 1 0 0 0 3

800.11 12747 6.2 9667 2.2 0 0 84.47984
0 12.30769 0 38.46154 12.06855
7.692308 96.54839 58.46154 0 1 0 0 0 3

900.11 3834 28.4 7866 8.8 30.4 0 250.0893
0 24.65753 0 71.23288 0
1.369863 250.0893 97.26027 0 1 0 0 0 3

1000.11 2535 21.6 13057 5 67.2 0 148.8095
0 11.32076 0 33.96227 0
3.773585 148.8095 49.05661 0 1 0 0 0 3

1100.11 5459 75.1 11629 7 12.9 0 237.4491
0 16.66667 0 36.11111 16.96065
1.851852 254.4098 54.62963 0 1 0 0 0 3

1200.11 456 8.5 8888 18.5 62.6 0 769.2308
769.2308 1.754386 1.754386 110.5263 769.2308
1.754386 2307.693 114.0351 0 1 0 0 0 3

1300.11 5035 9.100001 14567 27.3 16.6 0 214.7075
0 21.62162 0 145.9459 161.0306
2.702703 375.738 170.2703 0 1 0 0 0 3

1400.11 7419 8.899999 13782 10 0 0 131.4925
0 19.5122 0 95.12195 98.61933
2.439025 230.1118 117.0732 0 1 0 0 0 3

1500.11 3840 10.5 17607 22.6 30.5 0 200.3205
0 7.692308 0 69.23078 120.1923
9.230769 320.5129 86.15384 0 1 0 0 0 3

1600.11 4295 3.4 16702 19.4 21.8 0 38.16794
0 21.31148 0 67.21311 38.16794
6.557377 76.33588 95.08197 0 1 0 0 0 3

1700.11 3293 1.3 21991 17.8 5.5 0 111.07
37.02333 8.536586 0 86.58536 0
3.658537 148.0933 98.78049 0 1 0 0 0 3

1800.11 6745 3.8 12159 11.9 20.8 0 89.84726
0 21.21212 0 48.48485 0
9.090909 89.84726 78.78788 0 1 0 0 0 3

1900.11 3970 10.3 14875 13.1 0 0 0
0 16.66667 0 21.79487 0
3.846154 0 42.3077 0 1 0 0 0 3

2000.11 6280 7.5 18270 6.4 2.1 0 94.45419
13.49346 17.79661 0 26.27119 0
1.694915 107.9476 45.76272 0 1 0 0 0 3

2100.11 41 0 8888 2.1 92 0 8823.529
0 2.439025 0 21.95122 0
2.439025 8823.529 26.82927 0 1 0 0 0 3

2200.11 4553 3.6 23317 11.2 19.5 0 112.6126
0 5.128206 0 20.51282 0
2.564103 112.6126 28.20513 0 1 0 0 0 3

2301.11 3100 2.9 40048 3.4 0 0 14.79509
0 4.128441 0 8.715596 0
.4587156 14.79509 13.30275 0 1 0 0 0 3

2302.11 2652 2.6 31691 3.8 0 0 0
0 3.278689 0 8.196721 0
.8196721 0 12.29508 0 1 0 0 0 3

2400.11 3212 4.2 29130 2.3 0 0 0
0 3.821656 0 5.732484 19.82947
1.910828 19.82947 11.46497 0 1 0 0 0 3

2500.11 5060 2.8 20908 16 4 0 54.14185
54.14185 13.69863 0 24.65753 0
1.369863 108.2837 39.72603 0 1 0 0 0 3

2600.11 4882 1.8 21442 8.7 0 0 33.45601
0 2.884616 0 18.26923 0
.9615385 33.45601 22.11539 0 1 0 0 0 3

2700.11 4704 3.7 28340 16.5 0 0 46.21072
23.10536 8.695652 0 39.13044 23.10536
2.173913 92.42144 50 0 1 0 0 0 3

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21.76752 15.78947 0 36.84211 65.30257
1.31579 108.8376 53.94737 0 0 0 0 1 6

700.23 7300 1.7 18806 16.7 0 0 472.3666
0 48.27587 0 93.10346 94.47331
6.896552 566.8399 148.2759 0 0 0 0 1 6

800.23 12747 6.2 9667 2.2 0 0 229.3025
48.2742 32.30769 4.615385 76.92308 24.1371
9.230769 301.7137 118.4615 0 0 0 0 1 6

900.23 3834 28.4 7866 8.8 30.4 35.72704 1036.084
71.45409 43.83562 1.369863 35.61644 178.6352
9.589041 1321.901 89.0411 0 0 0 0 1 6

1000.23 2535 21.6 13057 5 67.2 0 669.6429
148.8095 13.20755 0 20.75472 74.40476
0 892.8572 33.96227 0 0 0 0 1 6

1100.23 5459 75.1 11629 7 12.9 0 440.977
33.9213 25 0 32.40741 33.9213
2.777778 508.8196 60.18518 0 0 0 0 1 6

1200.23 456 8.5 8888 18.5 62.6 0 1153.846
0 8.77193 0 7.017544 384.6154
1.754386 1538.462 17.54386 0 0 0 0 1 6

1300.23 5035 9.100001 14567 27.3 16.6 0 590.4455
0 27.02703 0 45.94595 53.67687
8.108108 644.1224 81.0811 0 0 0 0 1 6

1400.23 7419 8.899999 13782 10 0 32.87311 460.2235
0 39.02439 2.439025 68.29269 32.87311
9.756098 525.9698 117.0732 0 0 0 0 1 6

1500.23 3840 10.5 17607 22.6 30.5 0 360.5769
0 15.38462 1.538462 56.92308 120.1923
6.153847 480.7693 78.46154 0 0 0 0 1 6

1600.23 4295 3.4 16702 19.4 21.8 0 305.3435
0 13.11475 3.278689 73.7705 114.5038
4.918033 419.8473 91.80328 0 0 0 0 1 6

1700.23 3293 1.3 21991 17.8 5.5 0 74.04666
0 6.097561 0 41.46341 37.02333
6.097561 111.07 53.65854 0 0 0 0 1 6

1800.23 6745 3.8 12159 11.9 20.8 0 314.4654
134.7709 84.84848 0 127.2727 179.6945
6.060606 628.9308 218.1818 0 0 0 0 1 6

1900.23 3970 10.3 14875 13.1 0 0 258.3145
0 17.94872 2.564103 33.33334 32.28931
2.564103 290.6038 53.84616 0 0 0 0 1 6

2002.23 6280 7.5 18270 6.4 2.1 0 202.4018
26.98691 23.72882 1.694915 57.62712 53.97383
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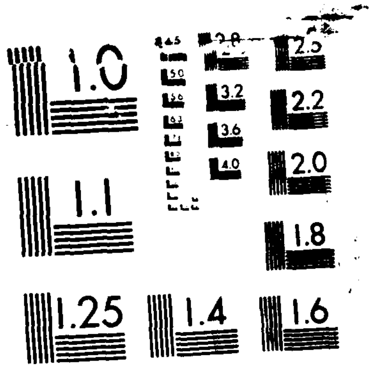
2100.23 41 0 8888 2.1 92 0 2941.177
0 2.439025 0 0 0
6.097561 2941.177 8.536585 0 0 0 0 1 6

2200.23 4553 3.6 23317 11.2 19.5 0 0
56.30631 10.25641 0 15.38462 0
5.128206 56.30631 30.76923 0 0 0 0 1 6

AD-A168 070 TIMING AND SPACING CRIME IN THE URBAN ENVIRONMENT: 3/3
LEXINGTON-FAYETTE COUNTY KENTUCKY - 1985(U) ARMY
MILITARY PERSONNEL CENTER ALEXANDRIA VA R C HAM
UNCLASSIFIED 01 MAY 86 F/G 5/11 NL



MICROCOPY RESOLUTION TEST CHART

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2302.23 2652 2.6 31691 3.8 0 0 30.90235
0 2.459016 0 19.67213 30.90235
0 61.8047 22.13115 0 0 0 0 1 6

2400.23 3212 4.2 29130 2.3 0 0 0
19.82947 2.547771 0 7.006369 19.82947
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2500.23 5060 2.8 20908 16 4 0 108.2837
0 19.17808 0 28.76712 0
0 108.2837 47.94521 0 0 0 0 1 6

2600.23 4882 1.8 21442 8.7 0 0 217.464
0 8.653847 0 29.80769 16.728
2.884616 234.192 41.34616 0 0 0 0 1 6

2700.23 4704 3.7 28340 16.5 0 0 161.7375
46.21072 5.434783 0 44.56522 23.10536
3.26087 231.0536 53.26087 0 0 0 0 1 6

2800.23 3622 2.5 22528 19.2 12.9 0 46.00874
0 17.5 0 15 69.01311
.8333333 115.0219 33.33333 0 0 0 0 1 6

2900.23 3857 .8 22711 4.8 0 0 46.2963
0 2.678572 0 8.928572 23.14815
0 69.44445 11.60714 0 0 0 0 1 6

3000.23 4040 1.8 22851 14 0 0 169.1007
15.37279 3.10559 0 24.2236 30.74558
1.242236 215.2191 28.57143 0 0 0 0 1 6

3101.23 3566 5.3 19101 1.5 0 0 132.2401
0 3.773585 0 20.75472 0
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3102.23 4481 9.100001 23089 5.9 0 0 194.0492
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13.04348 291.0737 82.60871 0 0 0 0 1 6

3200.23 4553 3.8 22464 4.8 0 0 181.7356
30.28926 11.03448 0 27.58621 45.4339
7.586207 257.4588 46.2069 0 0 0 0 1 6

3300.23 3686 7 18304 10.9 1.2 0 336.8794
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3401.23 5190 8.100001 22306 2.5 0 0 171.6738
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3402.23 3002 5.1 18457 15.2 0 0 394.3909
43.82121 14.47368 0 23.68421 175.2848
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3403.23 1063 7.7 22449 2.1 0 0 287.7238
0 0 0 7.482993 0
1.020408 287.7238 10.54422 0 0 0 0 1 6

3501.23 6654 2.9 20938 19.1 0 0 273.224
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3502.23 5265 5.8 19259 .2 0 0 226.7574
56.68934 16.41791 0 47.76119 28.34467
5.970149 311.7914 70.14925 0 0 0 0 1 6

3600.23 2326 1.8 36453 4.9 0 0 28.4657
0 1.986755 0 6.622517 28.4657
2.649007 56.9314 11.25828 0 0 0 0 1 6

3700.23 113 21.6 22661 .1 9.7 0 190.3208
54.37738 .2479083 0 .2788968 0
3.098853E-02 244.6982 .5577936 0 0 0 0 1 6

3801.23 1798 66.7 15238 1.4 5.5 0 421.6074
26.35046 5.924171 .7109005 17.77251 26.35046
1.421801 474.3083 25.11849 0 0 0 0 1 6

3802.23 61 7.2 18723 .6 .1 0 71.99424
35.99712 .1760176 0 .2860286 107.9914
.0660066 215.9827 .5280528 0 0 0 0 1 6

3901.23 2453 13.7 17350 21.2 26.2 0 498.5337
58.65103 17.98561 0 38.1295 322.5806
4.316547 879.7654 60.43166 0 0 0 0 1 6

3902.23 68 6.8 18277 1 2.9 0 110.5705
22.11411 .257732 0 .515464 22.11411
6.064282E-02 154.7988 .8338388 0 0 0 0 1 6

4001.23 3992 14.3 17848 .3 0 0 163.3542
27.2257 9.782609 0 13.04348 27.2257
4.347826 217.8056 27.17392 0 0 0 0 1 6

4002.23 52 1.9 19402 .2 1.2 0 318.9793
53.16321 .1397038 2.794077E-02 .5588153 53.16321
5.588153E-02 425.3057 .7544006 0 0 0 0 1 6

4101.23 3241 3.8 22121 4.5 0 0 61.70935
30.85467 5 0 20 0
1 92.56402 26 0 0 0 0 1 6

4102.23 983 3 27256 .5 0 0 114.2857
0 0 0 2.621723 0
.3745318 114.2857 2.996255 0 0 0 0 1 6

4201.23 1165 3.1 27924 6.1 20.3 0 120.6273
0 .8032128 0 4.618474 0
.8032128 120.6273 6.2249 0 0 0 0 1 6

4202.23 89 14.3 25219 10 0 0 161.1604
80.58018 .5076142 0 .5076142 0
7.251631E-02 241.7406 1.087745 0 0 0 0 1 6

100.03 7437 25.7 9246 47.1 10.2 0 301.0235
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200.03 6338 48.8 11747 10 21.2 0 121.3592
48.54369 29.23077 0 16.92308 24.27185
6.153847 194.1748 52.3077 0 0 0 0 0 1

300.03 10478 71.3 10153 9.7 5.4 0 232.7747
69.8324 36.58537 2.439025 17.07317 69.8324
4.878049 372.4395 58.53659 0 0 0 0 0 1

400.03 10239 75.1 5479 9.5 29.5 0 181.6943
22.71179 37.2093 0 27.90698 22.71179
2.325581 227.1179 67.44186 0 0 0 0 0 1

500.03 7109 4.1 15993 11.5 3.6 0 69.17225
0 14.7541 4.918033 19.67213 0
0 69.17225 34.42623 0 0 0 0 0 1

600.03 6044 .8 25758 10.8 0 0 65.30257
0 11.84211 0 1.31579 0
0 65.30257 13.1579 0 0 0 0 0 1

700.03 7300 1.7 18806 16.7 0 0 94.47331
47.23666 24.13793 0 24.13793 0
0 141.71 48.27587 0 0 0 0 0 1

800.03 12747 6.2 9667 2.2 0 0 60.34275
12.06855 23.07692 1.538462 12.30769 24.1371
1.538462 96.54839 36.92308 0 0 0 0 0 1

900.03 3834 28.4 7866 8.8 30.4 0 107.1811
71.45409 19.17808 2.739726 8.219178 35.72704
1.369863 214.3623 28.76712 0 0 0 0 0 1

1000.03 2535 21.6 13057 5 67.2 0 74.40476
0 9.433963 1.886793 3.773585 0
1.886793 74.40476 15.09434 0 0 0 0 0 1

1100.03 5459 75.1 11629 7 12.9 0 50.88196
16.96065 17.59259 1.851852 7.407408 16.96065
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1200.03 456 8.5 8888 18.5 62.6 0 0
0 0 0 5.263158 384.6154
0 384.6154 5.263158 0 0 0 0 0 1

1300.03 5035 9.100001 14567 27.3 16.6 0 53.67687
0 32.43243 0 27.02703 53.67687
0 107.3537 59.45946 0 0 0 0 0 1

1400.03 7419 8.899999 13782 10 0 0 65.74623
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1500.03 3840 10.5 17607 22.6 30.5 0 80.12821
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1600.03 4295 3.4 16702 19.4 21.8 0 114.5038
0 9.836065 1.639344 24.59017 76.33588
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1700.03 3293 1.3 21991 17.8 5.5 0 111.07
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1800.03 6745 3.8 12159 11.9 20.8 0 134.7709
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1900.03 3970 10.3 14875 13.1 0 0 96.86794
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1.282051 129.1572 15.38462 0 0 0 0 0 1

2000.03 6280 7.5 18270 6.4 2.1 0 67.46728
13.49346 11.01695 0 7.627119 0
3.389831 80.96073 22.0339 0 0 0 0 0 1

2100.03 41 0 8888 2.1 92 0 0
0 0 0 1.219512 0
2.439025 0 3.658537 0 0 0 0 0 1

2200.03 4553 3.6 23317 11.2 19.5 0 56.30631
0 2.564103 0 2.564103 0
0 56.30631 5.128206 0 0 0 0 0 1

2301.03 3100 2.9 40048 3.4 0 0 29.59018
0 2.752294 0 1.376147 14.79509
0 44.38526 4.128441 0 0 0 0 0 1

2302.03 2652 2.6 31691 3.8 0 0 0
0 1.639344 0 2.459016 0
0 0 4.098361 0 0 0 0 0 1

2400.03 3212 4.2 29130 2.3 0 0 0
19.82947 2.547771 0 .6369426 39.65894
.6369426 59.48841 3.821656 0 0 0 0 0 1

2500.03 5060 2.8 20908 16 4 0 27.07093
0 9.589041 0 6.849315 0
1.369863 27.07093 17.80822 0 0 0 0 0 1

2600.03 4882 1.8 21442 8.7 0 0 50.18401
0 .9615385 0 7.692308 16.728
0 66.91201 8.653847 0 0 0 0 0 1

2700.03 4704 3.7 28340 16.5 0 0 23.10536
0 6.521739 0 11.95652 23.10536
1.086957 46.21072 19.56522 0 0 0 0 0 1

2800.03 3622 2.5 22528 19.2 12.9 0 0
0 5.833333 0 7.5 23.00437
0 23.00437 13.33333 0 0 0 0 0 1

2900.03 3857 .8 22711 4.8 0 0 0
0 .8928571 0 2.678572 0
.8928571 0 4.464286 0 0 0 0 0 1

3000.03 4040 1.8 22851 14 0 0 0
15.37279 3.10559 0 4.968944 0
0 15.37279 8.074536 0 0 0 0 0 1

3101.03 3566 5.3 19101 1.5 0 0 26.44803
0 1.886793 0 5.660378 0
3.773585 26.44803 11.32076 0 0 0 0 0 1

3102.03 4481 9.100001 23089 5.9 0 0 64.68305
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2.898551 97.02458 15.94203 0 0 0 0 0 1

3200.03 4553 3.8 22464 4.8 0 0 15.14463
0 4.137931 0 6.896552 0
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3300.03 3686 7 18304 10.9 1.2 0 53.19149
17.7305 10.45752 0 9.803922 17.7305
1.30719 88.65248 21.56863 0 0 0 0 0 1

3401.03 5190 8.100001 22306 2.5 0 0 57.22461
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3402.03 3002 5.1 18457 15.2 0 0 175.2848
0 9.210526 0 6.578948 43.82121
0 219.1061 15.78948 0 0 0 0 0 1

3403.03 1063 7.7 22449 2.1 0 0 31.96931
0 1.70068 0 .6802721 0
0 31.96931 2.380952 0 0 0 0 0 1

3501.03 6654 2.9 20938 19.1 0 0 0
27.32241 7.272727 0 9.090909 54.64481
0 81.96722 16.36364 0 0 0 0 0 1

3502.03 5265 5.8 19259 .2 0 0 28.34467
0 4.477612 0 5.970149 0
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3600.03 2326 1.8 36453 4.9 0 0 0
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0 0 .6622516 0 0 0 0 0 1

3700.03 113 21.6 22661 .1 9.7 0 0
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3801.03 1798 66.7 15238 1.4 5.5 0 65.87615
26.35046 3.554503 0 4.265404 13.17523
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3802.03 61 7.2 18723 .6 .1 0 0
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.0440044 35.99712 .110011 0 0 0 0 0 1

3901.03 2453 13.7 17350 21.2 26.2 0 87.97654
0 7.913669 0 9.352518 0
0 87.97654 17.26619 0 0 0 0 0 1

3902.03 68 6.8 18277 1 2.9 0 44.22822
0 6.064282E-02 0 .0151607 0
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4001.03 3992 14.3 17848 .3 0 0 27.2257
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4002.03 52 1.9 19402 .2 1.2 0 0
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2.794077E-02 0 .1397038 0 0 0 0 0 1

4101.03 3241 3.8 22121 4.5 0 0 30.85467
0 1 0 6 0
0 30.85467 7 0 0 0 0 0 1

4102.03 983 3 27256 .5 0 0 0
0 .3745318 0 .3745318 0
0 0 .7490637 0 0 0 0 0 1

4201.03 1165 3.1 27924 6.1 20.3 0 0
0 .8032128 0 .8032128 17.23247
0 17.23247 1.606426 0 0 0 0 0 1

4202.03 89 14.3 25219 10 0 0 0
0 .1450326 0 .1450326 0
0 0 .2900653 0 0 0 0 0 1

APPENDIX F

SPACE-TIME UNIT REGRESSION RESULTS

Homicides per 100,000 - Socioeconomic Variables Only

R^2 = .04649 F = 4.81067 Signif F = .0028

Variable	B	BETA	Sig T
MedFam$	-.00013	-.16205	.0269
Comm%	.05219	.08163	.1772
Nonwh%	.00860	.03008	.6680
Constant	3.01254		.0513

Homicides per 100,000 - Time Variables Added

R^2 = .06743 F = 2.63014 Signif F = .0085

Variable	B	BETA	Sig T
T23-03	1.77337	.11926	.1038
MedFam$	-.00013	-.16205	.0265
T19-23	2.17517	.14628	.0463
Comm%	.05219	.08163	.1761
T15-19	1.38391	.09307	.2039
T11-15	.45424	.03055	.6763
Nonwh%	.00860	.03008	.6672
T07-11	.33921	.02281	.7552
Constant	1.99155		.2391

Rape per 100,000 - Socioeconomic Variables Only

R^2 = .15349 F = 17.89065 Signif F = .0000

Variable	B	BETA	Sig T
MedFam$	-.00075	-.16647	.0159
Comm%	.56165	.15892	.0055
Nonwh%	.34138	.21588	.0012
Constant	25.17178		.0019

Rape per 100,000 - Time Variables Added

R^2 = .21723 F = 13.55225 Signif F = .0000

Variable	B	BETA	Sig T
T23-03	20.41709	.24839	.0000
MedFam$	-.00075	-.16647	.0126
T19-23	9.09514	.11053	.0434
Comm%	.56165	.15892	.0041
T15-19	12.24641	.14899	.0066
Nonwh%	.34138	.21588	.0008
Constant	18.21367		.0220

Robbery per 100,000 - Socioeconomic Variables Only

R^2 = .30442 F = 43.18108 Signif F = .0000

Variable	B	BETA	Sig T
MedFam$	-.00141	-.14329	.0220
Comm%	3.30186	.42876	.0000
Nonwh%	.66610	.19331	.0014
Constant	25.01599		.1153

Robbery per 100,000 - Time Variables Added

R^2 = .41543 F = 41.78625 Signif F = .0000

Variable	B	BETA	Sig T
T23-03	42.03948	.23472	.0000
MedFam$	-.00141	-.14329	.0128
T19-23	51.58779	.28803	.0000
Comm%	3.30186	.42876	.0000
Nonwh%	.66610	.19331	.0005
Constant	9.41145		.5231

Assault per 100,000 - Socioeconomic Variables Only

R^2 = .38156 F = 60.87429 Signif F = .0000

Variable	B	BETA	Sig T
MedFam$	-.00870	-.26268	.0000
Comm%	6.51652	.25067	.0000
Nonwh%	3.95570	.34006	.0000
Const.	231.13020		.0000

Assault per 100,000 - Time Variables Added

R^2 = .57843 F = 67.00443 Signif F = .0000

Variable	B	BETA	Sig T
T23-03	213.19354	.35261	.0000
MedFam$	-.00870	-.26268	.0000
T19-23	229.03882	.37882	.0000
Comm%	6.51652	.25067	.0000
T15-19	126.05731	.20849	.0000
Nonwh%	3.95570	.34006	.0000
Const.	136.41525		.0016

Violent Crime per 100,000 - Socioeconomic Variables Only

R^2 = .39822 F = 65.29202 Signif F = .0000

Variable	B	BETA	Sig T
MedFam$	-.01098	-.25360	.0000
Comm%	10.43222	.30678	.0000
Nonwh%	4.97178	.32675	.0000
Const.	284.33051		.0000

Violent Crime per 100,000 - Time Variables Added

R^2 = .59069 F = 70.47346 Signif F = .0000

Variable	B	BETA	Sig T
T23-03	280.16245	.35423	.0000
MedFam$	-.01098	-.25360	.0000
T19-23	294.62586	.37252	.0000
Comm%	10.43222	.30678	.0000
T15-19	151.43684	.19147	.0000
Nonwh%	4.97178	.32675	.0000
Const.	163.29298		.0033

Burglary per Square Mile - Socioeconomic Variables Only

R^2 = .56042 F = 125.79133 Signif F = .0000

Variable	B	BETA	Sig T
Popden	.00308	.38028	.0000
Comm%	.76120	.30453	.0000
MedFam$	-.00095	-.29704	.0000
Const.	15.81136		.0001

Burglary per Square Mile - Time Variables Added

R^2 = .63072   F = 71.24758   Signif F = .0000

Variable	B	BETA	Sig T
T07-11	5.12752	.08820	.0273
Popden	.00308	.38028	.0000
T15-19	15.52033	.26697	.0000
Comm%	.76120	.30453	.0000
T23-03	7.26151	.12491	.0019
T19-23	11.95817	.20570	.0000
MedFam$	-.00095	-.29704	.0000
Const.	9.16677		.0198

Larceny per Square Mile - Socioeconomic Variables Only

R^2 = .50822   F = 101.96680   Signif F = .0000

Variable	B	BETA	Sig T
Popden	.00410	.21923	.0000
Comm%	3.15135	.54691	.0000
MedFam$	-.00098	-.13402	.0054
Const.	10.30781		.3001

Larceny per Square Mile - Time Variables Added

R^2 = .65676   F = 69.60158   Signif F = .0000

Variable	B	BETA	Sig T
T23-03	28.52619	.21286	.0000
Popden	.00410	.21923	.0000
T19-23	54.79695	.40889	.0000
Comm%	3.15135	.54691	.0000
T15-19	51.68877	.38570	.0000
T11-15	29.35477	.21904	.0000
MedFam$	-.00098	-.13402	.0010
T07-11	14.65860	.10938	.0142
Const.	-19.52974		.0347

Auto Theft per Square Mile - Socioeconomic Variables Only

R^2 = .35236   F = 53.68032   Signif F = .0000

Variable	B	BETA	Sig T
Popden	.00040	.21735	.0001
Comm%	.19247	.33518	.0000
MedFam$	-.00017	-.23282	.0000
Const.	3.44764		.0026

Auto Theft per Square Mile - Time Variables Added

R^2 = .52411   F = 53.78138   Signif F = .0000

Variable	B	BETA	Sig T
T23-03	2.25666	.16898	.0001
Popden	.00040	.21735	.0000
T19-23	5.74350	.43006	.0000
Comm%	.19247	.33518	.0000
T15-19	2.14549	.16065	.0002
MedFam$	-.00017	-.23282	.0000
Const.	1.75670		.0797

Property Crime per Square Mile - Socioeconomic Variables Only

R^2 = .56959   F = 130.57016   Signif F = .0000

Variable	B	BETA	Sig T
Popden	.00758	.28440	.0000
Comm%	4.10502	.49923	.0000
MedFam$	-.00210	-.20047	.0000
Const.	29.56680		.0265

Property Crime per Square Mile - Time Variables Added

R^2 = .70532   F = 87.06587   Signif F = .0000

Variable	B	BETA	Sig T
T23-03	39.97563	.20903	.0000
Popden	.00758	.28440	.0000
T19-23	74.42988	.38919	.0000
Comm%	4.10502	.49923	.0000
T15-19	71.28585	.37275	.0000
T11-15	32.88826	.17197	.0000
MedFam$	-.00210	-.20047	.0000
T07-11	22.04644	.11528	.0054
Const.	-10.53754		.3873

Arson per Square Mile - Socioeconomic Variables Only

R^2 = .24395   F = 47.91631   Signif F = .0000

Variable	B	BETA	Sig T
Popden	.00132	.33076	.0000
MedFam$	-.00004	-.23554	.0001
Const.	.63152		.0131

Arson per Square Mile - Time Variables Added

R^2 = .27307 F = 15.67003 Signif F = .0000

Variable	B	BETA	Sig T
T11-15	-.27430	-.09590	.1376
Popden	.00013	.33076	.0000
T07-11	-.11942	-.04175	.5174
T15-19	.15208	.05317	.4098
T23-03	.18635	.06515	.3126
MedFam$	-.00004	-.23554	.0001
T19-23	.23817	.08327	.1971
Const.	.60104		.0308

APPENDIX G

SPACE-DAY UNIT DATA MATRIX

SDU PopDen Nonwh% MedFam$ Comm% Indu% Homic Asslt
Rape Burglary Arson Larceny Robbery
AutoTh ViolCrm PropCrm Tue Wed Thu Fri Sat Sun Day

100.1 7437 25.7 9246 47.1 10.2 0 381.2964
40.13646 83.5821 5.970149 267.1642 140.4776
22.38806 561.9105 373.1344 0 0 0 0 0 0 1

200.1 6338 48.8 11747 10 21.2 0 558.2525
0 35.38462 0 55.38462 145.6311
4.615385 703.8835 95.38462 0 0 0 0 0 0 1

300.1 10478 71.3 10153 9.7 5.4 0 581.9366
23.27747 43.90244 2.439025 68.29269 69.8324
0 675.0465 112.1951 0 0 0 0 0 0 1

400.1 10239 75.1 5479 9.5 29.5 0 567.7947
22.71179 34.88372 0 83.72093 113.5589
11.62791 704.0655 130.2326 0 0 0 0 0 0 1

500.1 7109 4.1 15993 11.5 3.6 0 115.2871
23.05741 34.42623 1.639344 73.7705 23.05741
0 161.4019 108.1967 0 0 0 0 0 0 1

600.1 6044 .8 25758 10.8 0 0 87.07009
21.76752 31.57895 0 35.52632 0
1.31579 108.8376 68.42105 0 0 0 0 0 0 1

700.1 7300 1.7 18806 16.7 0 0 141.71
0 24.13793 0 62.06897 47.23666
0 188.9466 86.20689 0 0 0 0 0 0 1

800.1 12747 6.2 9667 2.2 0 0 72.4113
12.06855 24.61539 0 60.00001 0
13.84615 84.47984 98.46154 0 0 0 0 0 0 1

900.1 3834 28.4 7866 8.8 30.4 0 285.8164
35.72704 50.68493 2.739726 54.79452 107.1811
5.479452 428.7245 110.9589 0 0 0 0 0 0 1

1000.1 2535 21.6 13057 5 67.2 0 297.6191
0 3.773585 0 35.84906 74.40476
0 372.0238 39.62265 0 0 0 0 0 0 1

1100.1 5459 75.1 11629 7 12.9 0 288.3311
0 20.37037 .9259259 23.14815 16.96065
.9259259 305.2917 44.44445 0 0 0 0 0 0 1

1200.1 456 8.5 8888 18.5 62.6 0 1153.846
769.2308 5.263158 0 57.89474 0
3.508772 1923.077 66.66666 0 0 0 0 0 0 1

1300.1 5035 9.100001 14567 27.3 16.6 0 107.3537
53.67687 24.32432 0 145.9459 161.0306
5.405406 322.0612 175.6757 0 0 0 0 0 0 1

1400.1 7419 8.899999 13782 10 0 0 197.2387
0 29.26829 0 82.92683 131.4925
9.756098 328.7311 121.9512 0 0 0 0 0 0 1

1500.1 3840 10.5 17607 22.6 30.5 0 80.12821
40.0641 29.23077 1.538462 66.15385 40.0641
9.230769 160.2564 104.6154 0 0 0 0 0 0 1

1600.1 4295 3.4 16702 19.4 21.8 0 38.16794
0 13.11475 1.639344 60.65574 76.33588
4.918033 114.5038 78.68853 0 0 0 0 0 0 1

1700.1 3293 1.3 21991 17.8 5.5 0 74.04666
37.02333 4.878049 0 67.07318 37.02333
4.878049 148.0933 76.82928 0 0 0 0 0 0 1

1800.1 6745 3.8 12159 11.9 20.8 0 89.84726
89.84726 51.51515 0 84.84848 0
3.030303 179.6945 139.3939 0 0 0 0 0 0 1

1900.1 3970 10.3 14875 13.1 0 0 161.4466
32.28931 10.25641 0 29.48718 0
1.282051 193.7359 41.02564 0 0 0 0 0 0 1

2000.1 6280 7.5 18270 6.4 2.1 0 0
13.49346 17.79661 0 48.30509 13.49346
5.932204 26.98691 72.03391 0 0 0 0 0 0 1

2100.1 41 0 8888 2.1 92 0 0
5882.353 1.219512 0 26.82927 0
1.219512 5882.353 29.2683 0 0 0 0 0 0 1

2200.1 4553 3.6 23317 11.2 19.5 0 112.6126
0 10.25641 0 15.38462 0
5.128206 112.6126 30.76923 0 0 0 0 0 0 1

2301.1 3100 2.9 40048 3.4 0 14.79509 59.18035
44.38527 5.045872 0 16.51376 0
.4587156 118.3607 22.01835 0 0 0 0 0 0 1

2302.1 2652 2.6 31691 3.8 0 0 0
0 5.737705 0 10.65574 0
0 0 16.39344 0 0 0 0 0 0 1

2400.1 3212 4.2 29130 2.3 0 0 0
19.82947 1.910828 .6369426 7.643312 39.65894
1.273885 59.48841 10.82803 0 0 0 0 0 0 1

2500.1 5060 2.8 20908 16 4 0 27.07093
0 5.479452 0 31.50685 0
0 27.07093 36.9863 0 0 0 0 0 0 1

2600.1 4882 1.8 21442 8.7 0 0 33.45601
0 12.5 0 25.96154 0
1.923077 33.45601 40.38462 0 0 0 0 0 0 1

2700.1 4704 3.7 28340 16.5 0 0 23.10536
0 9.782609 0 33.69565 46.21072
2.173913 69.31608 45.65217 0 0 0 0 0 0 1

2800.1 3622 2.5 22528 19.2 12.9 0 23.00437
0 12.5 0 25.83333 0
0 23.00437 38.33333 0 0 0 0 0 0 1

2900.1 3857 .8 22711 4.8 0 0 46.2963
0 2.678572 0 15.17857 23.14815
.8928571 69.44445 18.75 0 0 0 0 0 0 1

3000.1 4040 1.8 22851 14 0 0 46.11837
0 8.695652 0 47.20497 15.37279
1.242236 61.49116 57.14286 0 0 0 0 0 0 1

3101.1 3566 5.3 19101 1.5 0 0 79.3441
0 9.433963 0 16.03774 0
6.603774 79.3441 32.07548 0 0 0 0 0 0 1

3102.1 4481 9.100001 23089 5.9 0 0 32.34153
0 11.5942 0 40.57971 32.34153
7.246377 64.68305 59.42029 0 0 0 0 0 0 1

3200.1 4553 3.8 22464 4.8 0 0 136.3017
0 8.965517 0 15.86207 30.28926
2.758621 166.5909 27.58621 0 0 0 0 0 0 1

3300.1 3686 7 18304 10.9 1.2 0 88.65248
0 9.803922 0 30.71896 35.46099
5.882353 124.1135 46.40523 0 0 0 0 0 0 1

3401.1 5190 8.100001 22306 2.5 0 0 95.37434
9.537434 15.84158 0 23.76238 9.537434
1.485149 114.4492 41.08911 0 0 0 0 0 0 1

3402.1 3002 5.1 18457 15.2 0 0 43.82121
0 7.894737 0 25 0
5.263158 43.82121 38.1579 0 0 0 0 0 0 1

3403.1 1063 7.7 22449 2.1 0 0 159.8465
0 3.061225 0 5.782313 0
1.360544 159.8465 10.20408 0 0 0 0 0 0 1

3501.1 6654 2.9 20938 19.1 0 0 81.96721
0 23.63637 0 76.36363 0
1.818182 81.96721 101.8182 0 0 0 0 0 0 1

3502.1 5265 5.8 19259 .2 0 0 56.68934
0 10.44776 0 34.32836 0
1.492537 56.68934 46.26866 0 0 0 0 0 0 1

3600.1 2326 1.8 36453 4.9 0 0 0
0 3.311258 .6622516 5.960265 0
.6622516 0 9.933775 0 0 0 0 0 0 1

3700.1 113 21.6 22661 .1 9.7 0 54.37738
27.18869 .2479083 3.098853E-02 .3718624 27.18869
6.197707E-02 108.7548 .6817478 0 0 0 0 0 0 1

3801.1 1798 66.7 15238 1.4 5.5 0 210.8037
0 5.450238 .4739337 14.92891 39.52569
1.658768 250.3294 22.03792 0 0 0 0 0 0 1

3802.1 61 7.2 18723 .6 .1 0 71.99424
35.99712 .220022 0 .330033 71.99424
.0220022 179.9856 .5720573 0 0 0 0 0 0 1

3901.1 2453 13.7 17350 21.2 26.2 0 117.3021
58.65103 12.94964 0 40.28777 0
3.597123 175.9531 56.83454 0 0 0 0 0 0 1

3902.1 68 6.8 18277 1 2.9 0 154.7988
22.11411 .1667678 .0151607 .3790176 0
.1061249 176.9129 .6519103 0 0 0 0 0 0 1

4001.1 3992 14.3 17848 .3 0 0 81.6771
0 5.434783 0 13.04348 0
1.086957 81.6771 19.56522 0 0 0 0 0 0 1

4002.1 52 1.9 19402 .2 1.2 0 53.16321
0 .3073484 0 .2514669 53.16321
0 106.3264 .5588153 0 0 0 0 0 0 1

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4101.1  3241  3.8  22121  4.5  0  0  61.70935
0  1  0  15  0
0  61.70935  16  0  0  0  0  0  0  1

4102.1  983  3  27256  .5  0  0  76.19048
0  .3745318  0  1.498127  0
.3745318  76.19048  2.247191  0  0  0  0  0  0  1

4201.1  1165  3.1  27924  6.1  20.3  0  34.46493
17.23247  .8032128  0  15.66265  17.23247
1.405623  68.92986  17.87149  0  0  0  0  0  0  1

4202.1  89  14.3  25219  10  0  0  0
0  .3625816  0  .7976795  0
.1450326  0  1.305294  0  0  0  0  0  0  1

100.2  7437  25.7  9246  47.1  10.2  0  541.8423
40.13646  76.1194  4.477612  267.1642  260.887
16.41791  842.8658  359.7015  1  0  0  0  0  0  2

200.2  6338  48.8  11747  10  21.2  0  291.2621
48.54369  33.84615  1.538462  47.69231  194.1748
9.230769  533.9806  90.76923  1  0  0  0  0  0  2

300.2  10478  71.3  10153  9.7  5.4  0  675.0465
69.8324  87.80488  0  78.04878  162.9423
4.878049  907.8212  170.7317  1  0  0  0  0  0  2

400.2  10239  75.1  5479  9.5  29.5  0  272.5415
22.71179  34.88372  0  32.55814  90.84714
16.27907  386.1004  83.72093  1  0  0  0  0  0  2

500.2  7109  4.1  15993  11.5  3.6  0  115.2871
0  27.86885  1.639344  63.93443  46.11483
3.278689  161.4019  95.08196  1  0  0  0  0  0  2

600.2  6044  .8  25758  10.8  0  0  43.53505
0  28.94737  0  42.10527  65.30257
1.31579  108.8376  72.36843  1  0  0  0  0  0  2

700.2  7300  1.7  18806  16.7  0  0  188.9466
0  31.03448  0  117.2414  0
0  188.9466  148.2759  1  0  0  0  0  0  2

800.2  12747  6.2  9667  2.2  0  0  60.34275
12.06855  13.84615  1.538462  44.61539  12.06855
4.615385  84.47984  63.07693  1  0  0  0  0  0  2

900.2  3834  28.4  7866  8.8  30.4  0  714.5409
142.9082  46.57534  0  76.71233  0
6.849315  857.4491  130.137  1  0  0  0  0  0  2
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1000.2 2535 21.6 13057 5 67.2 0 372.0238
74.40476 5.660378 0 18.86793 0
5.660378 446.4286 30.18868 1 0 0 0 0 0 2

1100.2 5459 75.1 11629 7 12.9 0 220.4885
16.96065 19.44444 0 26.85185 16.96065
1.851852 254.4098 48.14815 1 0 0 0 0 0 2

1200.2 456 8.5 8888 18.5 62.6 0 769.2308
0 3.508772 0 63.1579 769.2308
7.017544 1538.462 73.68421 1 0 0 0 0 0 2

1300.2 5035 9.100001 14567 27.3 16.6 0 322.0612
0 21.62162 0 132.4324 107.3537
8.108108 429.4149 162.1622 1 0 0 0 0 0 2

1400.2 7419 8.899999 13782 10 0 0 262.9849
0 41.46341 2.439025 78.04878 0
7.317074 262.9849 126.8293 1 0 0 0 0 0 2

1500.2 3840 10.5 17607 22.6 30.5 0 240.3846
40.0641 24.61539 0 56.92308 40.0641
7.692308 320.5128 89.23078 1 0 0 0 0 0 2

1600.2 4295 3.4 16702 19.4 21.8 38.16794 114.5038
38.16794 26.22951 0 50.81967 38.16794
6.557377 229.0076 83.60655 1 0 0 0 0 0 2

1700.2 3293 1.3 21991 17.8 5.5 0 74.04666
37.02333 9.756098 0 56.09756 37.02333
4.878049 148.0933 70.73171 1 0 0 0 0 0 2

1800.2 6745 3.8 12159 11.9 20.8 44.92363 269.5418
0 42.42424 0 81.81818 179.6945
15.15152 494.1599 139.3939 1 0 0 0 0 0 2

1900.2 3970 10.3 14875 13.1 0 0 258.3145
0 17.94872 0 29.48718 0
2.564103 258.3145 50 1 0 0 0 0 0 2

2000.2 6280 7.5 18270 6.4 2.1 0 107.9477
26.98691 15.25424 0 40.67797 26.98691
3.389831 161.9215 59.32204 1 0 0 0 0 0 2

2100.2 41 0 8888 2.1 92 0 0
0 4.878049 0 17.07317 0
1.219512 0 23.17074 1 0 0 0 0 0 2

2200.2 4553 3.6 23317 11.2 19.5 0 0
56.30631 0 0 17.94872 0
0 56.30631 17.94872 1 0 0 0 0 0 2

2301.2 3100 2.9 40048 3.4 0 0 44.38527
14.79509 3.669725 0 9.633027 14.79509
1.376147 73.97545 14.6789 1 0 0 0 0 0 2

2302.2 2652 2.6 31691 3.8 0 0 30.90235
0 3.278689 0 16.39344 0
0 30.90235 19.67213 1 0 0 0 0 0 2

2400.2 3212 4.2 29130 2.3 0 0 0
0 4.458599 0 5.732484 0
.6369426 0 10.82803 1 0 0 0 0 0 2

2500.2 5060 2.8 20908 16 4 0 81.21278
0 20.54795 0 20.54795 0
2.739726 81.21278 43.83562 1 0 0 0 0 0 2

2600.2 4882 1.8 21442 8.7 0 0 100.368
16.728 12.5 .9615385 39.42308 16.728
0 133.824 51.92308 1 0 0 0 0 0 2

2700.2 4704 3.7 28340 16.5 0 0 46.21072
23.10536 15.21739 0 42.39131 0
3.26087 69.31608 60.86957 1 0 0 0 0 0 2

2800.2 3622 2.5 22528 19.2 12.9 0 46.00874
0 19.16667 1.666667 35.83333 0
0 46.00874 55 1 0 0 0 0 0 2

2900.2 3857 .8 22711 4.8 0 0 0
0 1.785714 0 9.821428 0
0 0 11.60714 1 0 0 0 0 0 2

3000.2 4040 1.8 22851 14 0 0 61.49116
0 2.484472 0 25.46584 15.37279
3.10559 76.86395 31.0559 1 0 0 0 0 0 2

3101.2 3566 5.3 19101 1.5 0 0 79.3441
0 9.433963 0 13.20755 0
4.716982 79.3441 27.35849 1 0 0 0 0 0 2

3102.2 4481 9.100001 23089 5.9 0 0 64.68305
64.68305 17.3913 1.449275 47.82609 194.0492
5.797102 323.4153 71.01451 1 0 0 0 0 0 2

3200.2 4553 3.8 22464 4.8 0 0 60.57852
45.4339 4.827586 0 24.13793 30.28926
7.586207 136.3017 36.55172 1 0 0 0 0 0 2

3300.2 3686 7 18304 10.9 1.2 0 195.0355
0 7.843138 .6535948 31.37255 0
7.189543 195.0355 46.40523 1 0 0 0 0 0 2

3401.2 5190 8.100001 22306 2.5 0 0 114.4492
19.07487 12.37624 0 18.81188 0
1.485149 133.5241 32.67327 1 0 0 0 0 2

3402.2 3002 5.1 18457 15.2 0 0 0
0 10.52632 0 34.21053 0
1.31579 0 46.05263 1 0 0 0 0 2

3403.2 1063 7.7 22449 2.1 0 0 95.90793
0 2.380952 0 6.802721 0
0 95.90793 9.183674 1 0 0 0 0 2

3501.2 6654 2.9 20938 19.1 0 0 109.2896
27.32241 10.90909 0 63.63637 0
5.454546 136.612 80 1 0 0 0 0 2

3502.2 5265 5.8 19259 .2 0 0 85.03401
28.34467 16.41791 0 20.89552 0
2.985075 113.3787 40.29851 1 0 0 0 0 2

3600.2 2326 1.8 36453 4.9 0 0 28.4657
0 1.986755 0 7.284768 0
.6622516 28.4657 9.933775 1 0 0 0 0 2

3700.2 113 21.6 22661 .1 9.7 0 135.9435
0 .2169197 0 .3098854 27.18869
.0929656 163.1321 .6197707 1 0 0 0 0 2

3801.2 1798 66.7 15238 1.4 5.5 0 276.6799
13.17523 5.21327 .2369668 12.79621 26.35046
.7109005 316.2055 18.72038 1 0 0 0 0 2

3802.2 61 7.2 18723 .6 .1 0 107.9914
0 .110011 0 .2420242 71.99424
.0440044 179.9856 .3960396 1 0 0 0 0 2

3901.2 2453 13.7 17350 21.2 26.2 0 117.3021
0 16.54676 .7194245 38.84892 58.65103
2.877698 175.9531 58.27338 1 0 0 0 0 2

3902.2 68 6.8 18277 1 2.9 0 66.34233
44.22822 .2122499 .0151607 .515464 0
7.580352E-02 110.5705 .8035173 1 0 0 0 0 2

4001.2 3992 14.3 17848 .3 0 0 27.2257
27.2257 3.26087 0 6.521739 0
1.086957 54.45141 10.86956 1 0 0 0 0 2

4002.2 52 1.9 19402 .2 1.2 0 0
0 .1676446 2.794077E-02 .4191115 53.16321
.0838223 53.16321 .6705785 1 0 0 0 0 2

4101.2 3241 3.8 22121 4.5 0 0 61.70935
30.85467 3 0 19 0
0 92.56402 22 1 0 0 0 0 0 2

4102.2 983 3 27256 .5 0 0 0
0 0 0 .3745318 0
0 0 .3745318 1 0 0 0 0 0 2

4201.2 1165 3.1 27924 6.1 20.3 0 68.92986
17.23247 1.204819 0 22.48996 0
.2008032 86.16233 23.89558 1 0 0 0 0 0 2

4202.2 89 14.3 25219 10 0 0 80.58018
80.58018 .3625816 0 .8701958 0
.1450326 161.1604 1.37781 1 0 0 0 0 0 2

100.3 7437 25.7 9246 47.1 10.2 0 682.3199
140.4776 76.1194 4.477612 194.0299 260.887
2.985075 1083.685 273.1343 0 1 0 0 0 0 3

200.3 6338 48.8 11747 10 21.2 0 339.8058
0 24.61539 1.538462 63.07693 218.4466
6.153847 558.2525 93.84616 0 1 0 0 0 0 3

300.3 10478 71.3 10153 9.7 5.4 0 418.9945
46.55494 58.53659 4.878049 34.14634 69.8324
9.756098 535.3818 102.439 0 1 0 0 0 0 3

400.3 10239 75.1 5479 9.5 29.5 0 454.2357
45.42358 46.51163 0 51.16279 45.42358
2.325581 545.0829 100 0 1 0 0 0 0 3

500.3 7109 4.1 15993 11.5 3.6 0 92.22965
23.05741 22.95082 1.639344 70.4918 23.05741
4.918033 138.3445 98.36065 0 1 0 0 0 0 3

600.3 6044 .8 25758 10.8 0 0 21.76752
21.76752 31.57895 0 32.89474 0
1.31579 43.53505 65.78948 0 1 0 0 0 0 3

700.3 7300 1.7 18806 16.7 0 0 94.47331
0 55.17242 0 89.65518 0
0 94.47331 144.8276 0 1 0 0 0 0 3

800.3 12747 6.2 9667 2.2 0 0 60.34275
12.06855 26.15385 1.538462 50.76924 12.06855
4.615385 84.47984 81.53847 0 1 0 0 0 0 3

900.3 3834 28.4 7866 8.8 30.4 0 392.9975
71.45409 36.9863 1.369863 64.38356 107.1811
6.849315 571.6328 108.2192 0 1 0 0 0 0 3

1000.3 2535 21.6 13057 5 67.2 0 223.2143
0 1.886793 1.886793 26.4151 74.40476
1.886793 297.6191 30.18868 0 1 0 0 0 0 3

1100.3 5459 75.1 11629 7 12.9 16.96065 152.6459
16.96035 25.92593 0 23.14815 16.96065
2.777778 203.5278 51.85185 0 1 0 0 0 0 3

1200.3 456 8.5 8888 18.5 62.6 0 0
0 3.508772 1.754386 63.1579 1538.462
5.263158 1538.462 71.92983 0 1 0 0 0 0 3

1300.3 5035 9.100001 14567 27.3 16.6 0 214.7075
0 24.32432 0 143.2432 0
5.405406 214.7075 172.973 0 1 0 0 0 0 3

1400.3 7419 8.899999 13782 10 0 0 164.3655
32.87311 34.14634 0 104.8781 0
2.439025 197.2387 141.4634 0 1 0 0 0 0 3

1500.3 3840 10.5 17607 22.6 30.5 0 160.2564
0 7.692308 1.538462 53.84616 80.12821
12.30769 240.3846 73.84616 0 1 0 0 0 0 3

1600.3 4295 3.4 16702 19.4 21.8 0 152.6718
0 22.95082 1.639344 63.93443 38.16794
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4201.5 1165 3.1 27924 6.1 20.3 0 51.6974
0 .2008032 0 17.87149 0
1.204819 51.6974 19.27711 0 0 0 1 0 0 5

4202.5 89 14.3 25219 10 0 0 80.58018
0 .2900653 0 .7976795 0
.217549 80.58018 1.305294 0 0 0 1 0 0 5

100.6 7437 25.7 9246 47.1 10.2 0 983.3434
100.3412 95.52239 1.492537 249.2537 200.6823
26.86567 1284.367 371.6418 0 0 0 0 1 0 6

200.6 6338 48.8 11747 10 21.2 0 655.3398
48.54369 41.53846 0 44.61539 48.54369
9.230769 752.4272 95.38462 0 0 0 0 1 0 6

300.6 10478 71.3 10153 9.7 5.4 0 744.879
46.55494 53.65854 2.439025 87.80488 116.3873
14.63415 907.8212 156.0976 0 0 0 0 1 0 6

400.6 10239 75.1 5479 9.5 29.5 0 476.9475
45.42358 60.46512 0 67.44186 90.84714
9.302325 613.2183 137.2093 0 0 0 0 1 0 6

500.6 7109 4.1 15993 11.5 3.6 0 115.2871
0 32.78689 1.639344 73.7705 0
6.557377 115.2871 113.1148 0 0 0 0 1 0 6

600.6 6044 .8 25758 10.8 0 0 0
21.76752 25 0 35.52632 0
3.947369 21.76752 64.47369 0 0 0 0 1 0 6

700.6 7300 1.7 18806 16.7 0 0 519.6032
0 37.93104 0 103.4483 0
0 519.6032 141.3793 0 0 0 0 1 0 6

800.6 12747 6.2 9667 2.2 0 0 60.34275
12.06855 38.46154 4.615385 52.3077 24.1371
4.615385 96.54839 95.38462 0 0 0 0 1 0 6

900.6 3834 28.4 7866 8.8 30.4 35.72704 821.7221
107.1811 38.35616 1.369863 57.53425 35.72704
9.589041 1000.357 105.4795 0 0 0 0 1 0 6

1000.6 2535 21.6 13057 5 67.2 0 892.8572
0 9.433963 0 50.9434 148.8095
5.660378 1041.667 66.03775 0 0 0 0 1 0 6

1100.6 5459 75.1 11629 7 12.9 0 339.2131
50.88196 22.22222 .9259259 20.37037 0
2.777778 390.095 45.37037 0 0 0 0 1 0 6

1200.6 456 8.5 8888 18.5 62.6 0 1923.077
384.6154 3.508772 0 75.4386 384.6154
1.754386 2692.308 80.70176 0 0 0 0 1 0 6

1300.6 5035 9.100001 14567 27.3 16.6 0 483.0918
53.67687 35.13514 0 124.3243 214.7075
0 751.4761 159.4595 0 0 0 0 1 0 6

1400.6 7419 8.899999 13782 10 0 0 558.8428
0 31.70732 2.439025 87.80488 32.87311
9.756098 591.716 129.2683 0 0 0 0 1 0 6

1500.6 3840 10.5 17607 22.6 30.5 0 520.8334
40.0641 10.76923 0 89.23078 120.1923
7.692308 681.0898 107.6923 0 0 0 0 1 0 6

1600.6 4295 3.4 16702 19.4 21.8 0 152.6718
0 24.59017 1.639344 63.93443 114.5038
16.39344 267.1756 104.918 0 0 0 0 1 0 6

1700.6 3293 1.3 21991 17.8 5.5 0 185.1166
37.02333 17.07317 0 87.80488 0
12.19512 222.14 117.0732 0 0 0 0 1 0 6

1800.6 6745 3.8 12159 11.9 20.8 0 404.3127
44.92363 78.78788 0 75.75758 44.92363
15.15152 494.1599 169.697 0 0 0 0 1 0 6

1900.6 3970 10.3 14875 13.1 0 0 193.7359
64.57862 23.07692 0 29.48718 0
7.692308 258.3145 60.25641 0 0 0 0 1 0 6

2000.6 6280 7.5 18270 6.4 2.1 0 148.428
0 20.33898 0 44.91526 13.49346
5.084746 161.9215 70.33899 0 0 0 0 1 0 6

2100.6 41 0 8888 2.1 92 0 2941.177
0 6.097561 0 7.317074 0
2.439025 2941.177 15.85366 0 0 0 0 1 0 6

2200.6 4553 3.6 23317 11.2 19.5 0 56.30631
0 10.25641 0 17.94872 56.30631
2.564103 112.6126 30.76923 0 0 0 0 1 0 6

2301.6 3100 2.9 40048 3.4 0 0 73.97545
0 3.669725 0 15.13761 14.79509
.9174312 88.77053 19.72477 0 0 0 0 1 0 6

2302.6 2652 2.6 31691 3.8 0 0 61.8047
30.90235 4.098361 0 12.29508 0
0 92.70704 16.39344 0 0 0 0 1 0 6

2400.6 3212 4.2 29130 2.3 0 0 59.4884
0 4.458599 0 7.643312 59.4884
.6369426 118.9768 12.73885 0 0 0 0 1 0 6

2500.6 5060 2.8 20908 16 4 0 27.07093
27.07093 6.849315 0 28.76712 0
1.369863 54.14185 36.9863 0 0 0 0 1 0 6

2600.6 4882 1.8 21442 8.7 0 0 66.91201
33.45601 6.73077 0 23.07692 0
.9615385 100.368 30.76923 0 0 0 0 1 0 6

2700.6 4704 3.7 28340 16.5 0 0 0
46.21072 8.695652 0 58.69565 0
2.173913 46.21072 69.56523 0 0 0 0 1 0 6

2800.6 3622 2.5 22528 19.2 12.9 0 46.00874
0 22.5 0 45 92.01748
1.666667 138.0262 69.16666 0 0 0 0 1 0 6

2900.6 3857 .8 22711 4.8 0 0 46.2963
0 3.571429 0 17.85714 69.44445
.8928571 115.7407 22.32143 0 0 0 0 1 0 6

3000.6 4040 1.8 22851 14 0 0 107.6095
0 4.968944 0 50.31056 61.49116
1.242236 169.1007 56.52174 0 0 0 0 1 0 6

3101.6 3566 5.3 19101 1.5 0 0 105.7921
52.89606 4.716982 0 11.32076 0
4.716982 158.6882 20.75472 0 0 0 0 1 0 6

3102.6 4481 9.100001 23089 5.9 0 0 194.0492
32.34153 10.14493 0 47.82609 0
5.797102 226.3907 63.76812 0 0 0 0 1 0 6

3200.6 4553 3.8 22464 4.8 0 0 45.4339
0 10.34483 0 22.06897 30.28926
3.448276 75.72316 35.86207 0 0 0 0 1 0 6

3300.6 3686 7 18304 10.9 1.2 0 212.766
0 10.45752 .6535948 33.98693 35.46099
7.843138 248.2269 52.28758 0 0 0 0 1 0 6

3401.6 5190 8.100001 22306 2.5 0 0 143.0615
19.07487 11.88119 .4950495 17.82178 9.537434
1.980198 171.6738 31.68317 0 0 0 0 1 0 6

3402.6 3002 5.1 18457 15.2 0 0 438.2121
0 6.578948 0 38.1579 43.82121
3.947369 482.0333 48.68421 0 0 0 0 1 0 6

3403.6 1063 7.7 22449 2.1 0 0 95.90793
0 3.061225 0 4.421769 31.96931
0 127.8772 7.482993 0 0 0 0 1 0 6

3501.6 6654 2.9 20938 19.1 0 0 54.64481
27.32241 7.272727 1.818182 89.09091 0
0 81.96722 96.36363 0 0 0 0 1 0 6

3502.6 5265 5.8 19259 .2 0 0 198.4127
0 13.43284 0 26.86567 56.68934
2.985075 255.1021 43.28358 0 0 0 0 1 0 6

3600.6 2326 1.8 36453 4.9 0 0 56.9314
0 0 1.324503 5.298013 28.4657
.6622516 85.3971 5.960265 0 0 0 0 1 0 6

3700.6 113 21.6 22661 .1 9.7 0 54.37738
27.18869 .2788968 0 .6817478 81.56607
6.197707E-02 163.1321 1.022622 0 0 0 0 1 0 6

3801.6 1798 66.7 15238 1.4 5.5 0 237.1542
13.17523 8.530806 0 18.24645 0
1.895735 250.3294 28.67299 0 0 0 0 1 0 6

3802.6 61 7.2 18723 .6 .1 0 107.9914
0 .0880088 0 .4620462 0
.0880088 107.9914 .638064 0 0 0 0 1 0 6

3901.6 2453 13.7 17350 21.2 26.2 0 322.5806
58.65103 11.51079 0 35.2518 87.97654
5.755396 469.2082 52.51799 0 0 0 0 1 0 6

3902.6 68 6.8 18277 1 2.9 0 110.5705
0 .257732 .0151607 .6064281 22.11411
.1061249 132.6847 .9702851 0 0 0 0 1 0 6

4001.6 3992 14.3 17848 .3 0 0 245.0313
54.45141 10.86957 0 11.95652 27.2257
2.173913 326.7084 25 0 0 0 0 1 0 6

4002.6 52 1.9 19402 .2 1.2 0 159.4896
0 .0838223 0 .1955854 0
0 159.4896 .2794077 0 0 0 0 1 0 6

4101.6 3241 3.8 22121 4.5 0 0 30.85467
0 8 1 15 0
2 30.85467 25 0 0 0 0 1 0 6

4102.6 983 3 27256 .5 0 0 76.19048
0 1.123596 0 2.621723 0
0 76.19048 3.745318 0 0 0 0 1 0 6

4201.6 1165 3.1 27924 6.1 20.3 0 172.3247
17.23247 1.606426 0 22.28916 0
1.807229 189.5571 25.70281 0 0 0 0 1 0 6

4202.6 89 14.3 25219 10 0 0 80.58018
161.1604 .5801305 0 .9427121 0
7.251631E-02 241.7406 1.595359 0 0 0 0 1 0 6

100.7 7437 25.7 9246 47.1 10.2 0 581.9787
40.13646 74.62686 0 162.6866 160.5459
10.44776 782.661 247.7612 0 0 0 0 0 1 7

200.7 6338 48.8 11747 10 21.2 0 266.9903
24.27185 27.69231 0 43.07693 97.08738
3.076923 388.3495 73.84616 0 0 0 0 0 1 7

300.7 10478 71.3 10153 9.7 5.4 0 535.3818
69.8324 58.53659 4.878049 68.29269 116.3873
7.317074 721.6015 134.1464 0 0 0 0 0 1 7

400.7 10239 75.1 5479 9.5 29.5 0 590.5065
45.42358 41.86047 2.325581 46.51163 22.71179
13.95349 658.642 102.3256 0 0 0 0 0 1 7

500.7 7109 4.1 15993 11.5 3.6 0 138.3445
46.11483 22.95082 0 60.65574 0
3.278689 184.4593 86.88524 0 0 0 0 0 1 7

600.7 6044 .8 25758 10.8 0 0 43.53505
0 11.84211 0 28.94737 21.76752
2.631579 65.30257 43.42106 0 0 0 0 0 1 7

700.7 7300 1.7 18806 16.7 0 0 94.47331
0 13.7931 0 79.31035 0
10.34483 94.47331 103.4483 0 0 0 0 0 1 7

800.7 12747 6.2 9667 2.2 0 0 132.754
12.06855 21.53846 1.538462 32.30769 12.06855
3.076923 156.8911 56.92308 0 0 0 0 0 1 7

900.7 3834 28.4 7866 8.8 30.4 35.72704 428.7245
0 35.61644 4.109589 46.57534 71.45409
2.739726 535.9056 84.93149 0 0 0 0 0 1 7

1000.7 2535 21.6 13057 5 67.2 0 223.2143
148.8095 18.86793 1.886793 24.5283 0
3.773585 372.0238 47.16982 0 0 0 0 0 1 7

1100.7 5459 75.1 11629 7 12.9 0 271.3704
50.88196 17.59259 .9259259 30.55555 16.96065
1.851852 339.2131 50 0 0 0 0 0 1 7

1200.7 456 8.5 8888 18.5 62.6 0 384.6154
0 0 0 31.57895 769.2308
1.754386 1153.846 33.33333 0 0 0 0 0 1 7

1300.7 5035 9.100001 14567 27.3 16.6 0 268.3844
53.67687 8.108108 0 102.7027 0
5.405406 322.0612 116.2162 0 0 0 0 0 1 7

1400.7 7419 8.899999 13782 10 0 0 197.2387
0 29.26829 0 70.73171 131.4925
7.317074 328.7311 107.3171 0 0 0 0 0 1 7

1500.7 3840 10.5 17607 22.6 30.5 0 120.1923
0 9.230769 0 55.38462 0
7.692308 120.1923 72.3077 0 0 0 0 0 1 7

1600.7 4295 3.4 16702 19.4 21.8 0 114.5038
0 18.03279 1.639344 55.73771 0
4.918033 114.5038 78.68853 0 0 0 0 0 1 7

1700.7 3293 1.3 21991 17.8 5.5 0 0
0 8.536586 0 52.43903 74.04666
0 74.04666 60.97562 0 0 0 0 0 1 7

1800.7 6745 3.8 12159 11.9 20.8 0 89.84726
0 27.27273 3.030303 42.42424 179.6945
3.030303 269.5418 72.72728 0 0 0 0 0 1 7

1900.7 3970 10.3 14875 13.1 0 0 129.1572
0 10.25641 3.846154 30.76923 64.57862
5.128206 193.7359 46.15385 0 0 0 0 0 1 7

2000.7 6280 7.5 18270 6.4 2.1 0 188.9084
13.49346 9.322034 .8474576 37.28814 40.48037
4.237289 242.8822 50.84746 0 0 0 0 0 1 7

2100.7 41 0 8888 2.1 92 0 2941.177
0 1.219512 0 7.317074 0
1.219512 2941.177 9.756098 0 0 0 0 0 1 7

2200.7 4553 3.6 23317 11.2 19.5 0 56.30631
0 5.128206 0 33.33334 0
5.128206 56.30631 43.58975 0 0 0 0 0 1 7

2301.7 3100 2.9 40048 3.4 0 0 88.77053
0 5.045872 0 19.72477 14.79509
.4587156 103.5656 25.22936 0 0 0 0 0 1 7

2302.7 2652 2.6 31691 3.8 0 0 0
0 2.459016 0 9.836065 30.90235
.8196721 30.90235 13.11475 0 0 0 0 0 1 7

2400.7 3212 4.2 29130 2.3 0 0 39.65894
0 3.821656 0 5.095541 0
1.273885 39.65894 10.19108 0 0 0 0 0 1 7

2500.7 5060 2.8 20908 16 4 0 54.14185
0 15.06849 0 30.13699 0
1.369863 54.14185 46.57534 0 0 0 0 0 1 7

2600.7 4882 1.8 21442 8.7 0 0 33.45601
0 3.846154 0 25 0
1.923077 33.45601 30.76923 0 0 0 0 0 1 7

2700.7 4704 3.7 28340 16.5 0 0 92.42144
0 11.95652 0 34.78261 46.21072
1.086957 138.6322 47.82609 0 0 0 0 0 1 7

2800.7 3622 2.5 22528 19.2 12.9 0 46.00874
0 13.33333 0 12.5 23.00437
2.5 69.01311 28.33333 0 0 0 0 0 1 7

2900.7 3857 .8 22711 4.8 0 0 23.14815
0 2.678572 0 7.142857 23.14815
0 46.2963 9.821428 0 0 0 0 0 1 7

3000.7 4040 1.8 22851 14 0 0 92.23674
15.37279 4.968944 0 27.32919 30.74558
.621118 138.3551 32.91926 0 0 0 0 0 1 7

3101.7 3566 5.3 19101 1.5 0 0 26.44803
0 6.603774 0 15.09434 0
2.830189 26.44803 24.5283 0 0 0 0 0 1 7

3102.7 4481 9.100001 23089 5.9 0 0 129.3661
0 5.797102 0 30.43478 0
2.898551 129.3661 39.13044 0 0 0 0 0 1 7

3200.7 4553 3.8 22464 4.8 0 0 45.4339
15.14463 12.41379 0 16.55172 0
.6896551 60.57853 29.65517 0 0 0 0 0 1 7

3300.7 3686 7 18304 10.9 1.2 0 265.9574
35.46099 13.0719 0 28.75817 17.7305
3.921569 319.1489 45.75164 0 0 0 0 0 1 7

3401.7 5190 8.100001 22306 2.5 0 0 76.29948
9.537434 9.405941 .990099 24.75248 0
.990099 85.83691 35.14852 0 0 0 0 0 1 7

3402.7 3002 5.1 18457 15.2 0 0 219.1061
87.64242 5.263158 0 26.31579 87.64242
5.263158 394.3909 36.84211 0 0 0 0 0 1 7

3403.7 1063 7.7 22449 2.1 0 0 95.90793
31.96931 3.061225 0 2.040816 0
.3401361 127.8772 5.442177 0 0 0 0 0 1 7

3501.7 6654 2.9 20938 19.1 0 0 109.2896
0 14.54545 0 47.27273 109.2896
5.454546 218.5793 67.27273 0 0 0 0 0 1 7

3502.7 5265 5.8 19259 .2 0 0 28.34467
56.68934 14.92537 0 31.34328 28.34467
1.492537 113.3787 47.76119 0 0 0 0 0 1 7

3600.7 2326 1.8 36453 4.9 0 0 0
0 2.649007 0 7.284768 0
1.986755 0 11.92053 0 0 0 0 0 1 7

3700.7 113 21.6 22661 .1 9.7 0 54.37738
27.18869 .2169197 .0929656 .4338395 0
.2169197 81.56607 .8676789 0 0 0 0 0 1 7

3801.7 1798 66.7 15238 1.4 5.5 0 250.3294
26.35046 4.265404 .2369668 7.819906 26.35046
.4739337 303.0303 12.55924 0 0 0 0 0 1 7

3802.7 61 7.2 18723 .6 .1 0 107.9914
35.99712 .0880088 0 .4180418 0
.0220022 143.9885 .5280528 0 0 0 0 0 1 7

3901.7 2453 13.7 17350 21.2 26.2 0 205.2786
29.32552 6.47482 0 23.74101 29.32552
2.877698 263.9296 33.09353 0 0 0 0 0 1 7

3902.7 68 6.8 18277 1 2.9 0 110.5705
0 .257732 0 .4851426 22.11411
7.580352E-02 132.6847 .818678 0 0 0 0 0 1 7

4001.7 3992 14.3 17848 .3 0 0 190.5799
0 8.695652 0 8.695652 0
4.347826 190.5799 21.73913 0 0 0 0 0 1 7

4002.7 52 1.9 19402 .2 1.2 0 372.1425
53.16321 .0838223 0 .4470523 0
2.794077E-02 425.3057 .5588153 0 0 0 0 0 1 7

4101.7 3241 3.8 22121 4.5 0 0 61.70935
0 1 0 19 0
0 61.70935 20 0 0 0 0 0 1 7

4102.7 983 3 27256 .5 0 0 38.09524
0 .7490637 0 2.996255 0
.3745318 38.09524 4.11985 0 0 0 0 0 1 7

4201.7 1165 3.1 27924 6.1 20.3 0 103.3948
0 2.008032 0 12.6506 34.46493
0 137.8597 14.65863 0 0 0 0 0 1 7

4202.7 89 14.3 25219 10 0 0 161.1604
80.58018 .217549 0 .8701958 0
.1450326 241.7406 1.232777 0 0 0 0 0 1 7

APPENDIX H

SPACE-DAY UNIT REGRESSION RESULTS

Rapes per 100,000 - Socioeconomic Variables Only

R^2 = .16608 F = 22.96945 Signif F = .0000

Variable	B	BETA	Sig T
MedFam$	-.00070	-.16279	.0102
Comm%	.59043	.17564	.0009
Nonwh%	.34408	.22875	.0002
Constant	23.19890		.0010

Rapes per 100,000 - Day Variables Added

R^2 = .17579 F = 14.67351 Signif F = .0000

Variable	B	BETA	Sig T
Thursday	-4.55845	-.05474	.2709
MedFam$	-.00070	-.16279	.0100
Saturday	6.10257	.07329	.1408
Comm%	.59043	.17564	.0008
Nonwh%	.34408	.22875	.0002
Constant	22.97831		.0012

Robbery per 100,000 - Socioeconomic Variables Only

R^2 = .35613 F = 63.79312 Signif F = .0000

Variable	B	BETA	Sig T
MedFam$	-.00134	-.16928	.0024
Comm%	2.81351	.45418	.0000
Nonwh%	.57021	.20571	.0001
Constant	24.93867		.0285

Robbery per 100,000 - Day Variables Added

R^2 = .36123 F = 27.62886 Signif F = .0000

Variable	B	BETA	Sig T
Wednesday	-6.88885	-.04490	.3319
MedFam$	-.00134	-.16928	.0025
Saturday	7.22693	.04710	.3087
Friday	.88326	.00576	.9009
Comm%	2.81351	.45418	.0000
Thursday	-1.52749	-.00996	.8295
Nonwh%	.57021	.20571	.0001
Constant	24.98241		.0330

Assaults per 100,000 - Socioeconomic Variables Only

R^2 = .56973 F = 152.71358 Signif F = .0000

Variable	B	BETA	Sig T
MedFam$	-.00781	-.32180	.0000
Comm%	5.78344	.30348	.0000
Nonwh%	3.55168	.41651	.0000
Const.	206.73869		.0000

Assaults per 100,000 - Day Variables Added

R^2 = .61327 F = 136.77636 Signif F = .0000

Variable	B	BETA	Sig T
Saturday	98.50751	.20868	.0000
MedFam$	-.00781	-.32180	.0000
Comm%	5.78344	.30348	.0000
Nonwh%	3.55168	.41651	.0000
Const.	192.66619		.0000

Violent Crime per 100,000 - Socioeconomic Variables Only

R^2 = .60114 F = 173.82501 Signif F = .0000

Variable	B	BETA	Sig T
MedFam$	-.00995	-.31461	.0000
Comm%	9.23212	.37155	.0000
Nonwh%	4.47334	.40234	.0000
Const.	257.45842		.0000

Violent Crime per 100,000 - Day Variables Added

R^2 = .63525 F = 150.21147 Signif F = .0000

Variable	B	BETA	Sig T
Saturda	113.66491	.18468	.0000
MedFam$	-.00995	-.31461	.0000
Comm%	9.23212	.37155	.0000
Nonwh%	4.47334	.40234	.0000
Const.	241.22058		.0000

Burglary per Square Mile - Socioeconomic Variables Only

R^2 = .66388 F = 227.80135 Signif F = .0000

Variable	B	BETA	Sig T
Popden	.00294	.42944	.0000
Comm%	.67781	.32071	.0000
MedFam$	-.00085	-.31560	.0000
Const.	14.05354		.0000

Burglary per Square Mile - Day Variables Added

R^2 = .66972 F = 174.89199 Signif F = .0000

Variable	B	BETA	Sig T
Popden	.00294	.42944	.0000
Friday	3.99944	.07640	.0140
Comm%	.67781	.32071	.0000
MedFam$	-.00085	-.31560	.0000
Const.	13.48219		.0000

Larceny per Square Mile - Socioeconomic Variables Only

R^2 = .75905 F = 363.33548 Signif F = .0000

Variable	B	BETA	Sig T
Popden	.00400	.25623	.0000
Comm%	3.26122	.67682	.0000
MedFam$	-.00100	-.16317	.0000
Constant	10.58469		.0498

Larceny per Square Mile - Day Variables Added

R^2 = .76452 F = 280.02885 Signif F = .0000

Variable	B	BETA	Sig T
Sunday	-8.82703	.07396	.0049
Popden	.00400	.25623	.0000
Comm%	3.26122	.67682	.0000
MedFam$	-.00100	-.16317	.0000
Constant	11.84569		.0272

Auto Theft per Square Mile - Socioeconomic Variables Only

R^2 = .43748 F = 89.69717 Signif F = .0000

Variable	B	BETA	Sig T
Popden	.00036	.23238	.0000
Comm%	.17935	.37923	.0000
MedFam$	-.00016	-.26304	.0000
Constant	3.26760		.0001

Auto Theft per Square Mile - Day Variables Added

R^2 = .45291 F = 47.32546 Signif F = .0000

Variable	B	BETA	Sig T
Popden	.00036	.23238	.0000
Saturday	1.38462	.11820	.0045
Comm%	.17935	.37923	.0000
MedFam$	-.00016	-.26304	.0000
Constant	2.99625		.0003

Property Crime per Square Mile - Socioeconomic Variables Only

R^2 = .77939 F = 407.46936 Signif F = .0000

Variable	B	BETA	Sig T
Popden	.00730	.32536	.0000
Comm%	4.11838	.59496	.0000
MedFam$	-.00201	-.22792	.0000
Constant	27.90583		.0002

Property Crime per Square Mile - Day Variables Added

R^2 = .78758 F = 255.09294 Signif F = .0000

Variable	B	BETA	Sig T
Sunday	-11.99191	.06994	.0058
Popden	.00730	.32536	.0000
Comm%	4.11838	.59496	.0000
MedFam$	-.00201	-.22792	.0000
Constant	28.46908		.0001

Arson per Square Mile - Socioeconomic Variables Only

R^2 = .22416 F = 50.12819 Signif F = .0000

Variable	B	BETA	Sig T
Popden	.00011	.31445	.0000
MedFam$	-.00003	-.22869	.0000
Constant	.56716		.0084

Arson per Square Mile - Day Variables Added

R^2 = .23073 F = 25.86952 Signif F = .0000

Variable	B	BETA	Sig T
Wednesday	.05762	.02095	.6621
Popden	.00011	.31445	.0000
Thursday	-.20604	-.07491	.1187
MedFam$	-.00003	-.22869	.0000
Constant	.58836		.0067

Violent Crime per 100,000 - Stepwise With Expanded Variable Set

R^2 = .64449 F = 124.72718 Signif F = .0000

Variable	B	BETA	Sig T
MedFam$	-.00897	-.28333	.0000
Commer%	8.82545	.35518	.0000
Nonwh%	4.27526	.38453	.0000
Saturda.	113.66491	-.18468	.0000
Indust%	1.82978	.10821	.0030
Const.	214.21790		.0000

APPENDIX I

LEXINGTON REFERENCE MAP

NOTES

1. See, for example, Meddis, S. 1985. "Violence and Crime in the USA: Crime Rise Befuddles Pros", USA Today, Oct. 14, 1985, p. 2A.

2. For an overview of the debate, the reader is referred to The Professional Geographer, vol. 27(1975): Peet, R. Geography of Crime--A Political Critique, pp. 277-80; Harries, K. D. Geography of Crime--A Political Critique--Rejoinder, pp. 280-2; and vol. 28(1976): Peet, R. Further Comments on the Geography of Crime, pp. 98-100.

3. These variables follow closely those found to have the greatest explanatory power by Lee and Egan (1972, 60-3), and are generally consistent with the majority of readings cited above.

4. See SPSS-X User's Guide, New York: McGraw-Hill Book Company, 1983 for discussion of the techniques used.

5. The potential for autocorrelation in the data set cannot be dismissed without both a technical and a philosophical discussion. From a technical point of view, the crime data are a sample only in that some index crime may go unreported, however the fear of a prior selection having biased a subsequent selection is not as great as if we were drawing a random sample. Sack and others have also argued, philosophically, that ecological studies recognize, even depend upon the spatial and temporal connectivity between events, thus autocorrelation concerns are not troublesome. As a practical matter, all regression equations were tested using the Durbin-Watson statistic, and in most cases where the space-time (312) or space-day (364) units were used, the test supported acceptance of the null hypothesis that successive error terms are uncorrelated.

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